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THE MORPHOLOGY AND RELATIONSHIPS OF  
AUSTROBAILEYA

I. W. BAILEY AND B. G. L. SWAMY

*With seven plates and three text-figures*

INTRODUCTION

THE RELATIONSHIPS of this interesting genus have remained in doubt since it was first collected in 1929 by Kajewski on the Atherton Tableland in Northern Queensland. In his original description of the genus, White (11) stated:

"As Dr. Diels has done considerable work on the Magnoliales and allied groups, particularly those of the Papuan region, I sent specimens to him. He wrote me that he regarded the plant as undoubtedly belonging to the Magnoliaceae and allied to *Drimys*. He further suggested, though the fruits were unknown, that I should publish a provisional description in the account of Kajewski's collection. Unfortunately though Kajewski's specimens consist of several sheets of flowering specimens, the material has become extremely brittle in the process of drying with the result that the flowers are very difficult to soften and describe. It seems impossible also to section one of the carpels to see the number of ovules. Until living or spirit material of the flowers and ripe fruits can be obtained it will be impossible to place the plant in its correct botanical position. For the time being it is probably best placed at the end of the Magnoliaceae — even in a restricted sense — with position uncertain."

Subsequently, White modified this opinion in a letter written August 5, 1940 to Croizat: "Your letter of the 14th June to hand, and in reply I might state that when I was in England I spoke to Mr. Dandy at the British Museum, the recognized authority on the Magnoliaceae, about my *Austrobaileya*. I had, of course, only provisionally placed it in the Magnoliaceae. Specimens of the wood parts were examined at the Jodrell Laboratory by Dr. Metcalfe, and from floral structure and anatomy, we think there is no doubt the plant is a new family allied to Monimiaceae.

Dandy and I had intended to prepare a publication on it later on. I might have done something when I was over the other side, but the war upset plans a bit. It is most desirable, of course, that fruit should be found before it is raised to family rank."

Croizat (5) placed the genus in a new sub-family of the Dilleniaceae, viz., the Austrobaileyeae, and subsequently (6) in an independent family, the Austrobaileyaceae, without further discussion of its affinities.

It is evident, accordingly, that three different relationships have been suggested for *Austrobaileya*, 1. the Magnoliaceae, 2. the Monimiaceae and 3. the Dilleniaceae. The question whether the genus should be placed in one of these families or in an independent family of its own can be satisfactorily answered only by comprehensive morphological investigations of adequately preserved material. Through the efforts of Mr. L. J. Brass, and Mr. S. E. Stephens of the Department of Agriculture of North Queensland, we have succeeded in obtaining such material of the flowers and vegetative parts, collected at Lamonds Hill, close to the type locality of *Austrobaileya scandens* C. T. White.

#### MATERIAL EXAMINED

Our morphological investigations are based upon examination of the following material:

1. Isotype specimen of *A. scandens* C. T. White, *Kajewski 1269*, Arnold Arboretum.
2. Two isotype specimens of *A. scandens* C. T. White, *Kajewski 1269*, New York Botanical Garden.
3. Isotype specimen of *A. maculata* C. T. White (12), *White 10734*, Arnold Arboretum.
4. Stems and leaves of *A. maculata* C. T. White, *White 10734*, kindly sent by Mr. White.
5. Stems, terminal shoots and leaves of *A. scandens* C. T. White, collected and preserved in FAA fixative, *Brass 18160*.
6. Eleven herbarium specimens of *Brass 18160*.
7. Flowering shoots of *Austrobaileya*, preserved in FAA fixative, collected August 26, 1948 by Mr. Stephens in the Lamonds Hill area.

#### THE STEM

The largest scandent stem of *Austrobaileya*, *Brass 18160*, examined by us is 13 millimeters in diameter. Part of a transverse section of this stem is illustrated in *Plate I, Fig. 1*. The pith is composed of parenchymatous elements having thick, lignified, secondary walls. It is relatively homogeneous except for the presence of scattered cells having abundant starch and dark-colored phenolic material. In longitudinal sections, these cells are seen to occur in more or less extensive, vertically oriented files. The parenchymatous elements of the perimedullary region, *Fig. 1*, are slender, much elongated vertically, thick-walled and internally septate.



The cortex is composed of parenchymatous cells having thick, unligified, primary walls and containing abundant starch and more or less calcium oxalate in the form of "crystal sand." A considerable number of the cortical cells also contain dark-colored phenolic material. In the outer cortex of young stems, before the development of an extensive periderm, conspicuous secretory cells, i.e., "ethereal oil cells," are visible. These idioblasts are more or less spherical and have a tenuous suberized inner membrane.

The eustele of the stem is composed of numerous discrete strands of primary xylem and phloem which are faced externally by thick-walled septate fibres. During enlargement of the stem, as seen in transverse sections, *Fig. 1*, these arcs of phloem fibres form parts of a composite ring of sclerenchyma; the widening intervening spaces between the arcs of fibres being bridged by the formation of sclerotic parenchyma. The conspicuous multiseriate rays of the secondary body, *Fig. 1*, extend outward from the parenchymatous interfascicular lacunae of the eustele and exhibit considerable flaring in the secondary phloem. As is so frequently the case in scandent stems, there is a relatively abrupt transition in the secondary xylem between an inner first-formed zone of denser tissue and a subsequently formed, more porous part having conspicuously larger vessels.

The cambium is of a relatively primitive type, containing long (up to  $1500\mu$ ), extensively overlapping, fusiform initials. The derived sieve cells, vessel members and parenchyma strands are of equivalent lengths, but the imperforate tracheary cells, which elongate during maturation of the secondary xylem, are longer.

The parts of the secondary phloem between the flaring multiseriate rays, *Fig. 2*, are composed largely of alternating transverse bands of sieve cells and phloem parenchyma strands, the uniseriate rays being inconspicuous except where their cells contain dark-colored phenolic material. *The sieve cells have no companion cells.* Our observations regarding this important fact have been verified by Professor Katherine Esau to whom we sent preserved material for examination. The long, extensively overlapping sieve cells have numerous sieve plates in their lateral surfaces, those at the ends of the cells exhibiting no structural differences that might be interpreted as evidence of the presence of sieve tubes. There are no sclerenchymatous elements in the secondary phloem, all of the cells having primary walls only. Elongated secretory cells, i.e. "ethereal oil cells," are of sporadic occurrence.

The imperforate tracheary elements of the secondary xylem, *Fig. 3*, are of two types, 1. normal thick-walled tracheids which lose their living contents at maturity and 2. septate elements which contain several nuclei, more or less starch and dark-colored phenolic material. The former tracheary cells have numerous, conspicuously bordered pits (with included slit-like apertures) in both their radial and their tangential walls. However, the bordered pits fluctuate markedly in size in different tracheids, varying in diameter from  $3\mu$  to as much as  $10\mu$ . In the septate elements, the bordering areas of the pits fluctuate from conspicuous to vestigial.

The vessels of the secondary xylem range in size from diameters approximating those of the largest tracheids, i.e.  $30\mu$ , to diameters of as much as  $200\mu$ . All of the vessels regardless of size have scalariform perforation plates, but the form of the vessel members, and the number, size and character of the perforations changes markedly with increasing diameter of the vessels. In those of minimal cross-sectional area, the constituent cells are tracheid-like in form, i.e. fusiform with gradually tapered ends as seen in tangential longitudinal sections of the stem. The aggregations of scalariform bordered pits in the radial facets of the vessel members, *Fig. 5*, differ from those of scalariformly pitted tracheids only in the dissolution of pit-membranes in a number of the fully bordered pit-pairs. With increase in the diameter of the vessels, the perforated pit-pairs are reduced in number, greatly enlarged and lose most of their borders, compare *Figs. 5, 6* and *7*. In the case of the smaller vessels, the perforated pits occur in radial walls that are only slightly inclined to the long axis of the vessels, and therefore are fully visible in thick, radial longitudinal sections of the stem. On the contrary, during the ontogenetic expansion of large vessels, restricted parts of the radial facets, i.e. those in which perforations will ultimately be formed, assume an increasingly diagonal orientation, *Fig. 4*, and are fully visible in surface view, *Fig. 7*, only in sections cut at an inclination of approximately 45 degrees to the longitudinal axis of the stem.

Most of the vessels are diffusely scattered, but a few of the larger ones occur in tangentially oriented pairs, *Figs. 1* and *3*. Where the vessels are in contact with tracheids, the imperforate bordered pits are relatively large and circular, where in contact with rays or wood parenchyma strands, the pits are smaller but clearly bordered. Where vessels are in contact laterally, the imperforate bordered pits are large, more or less transversely elongated and in opposite or alternating, multiseriate arrangement.

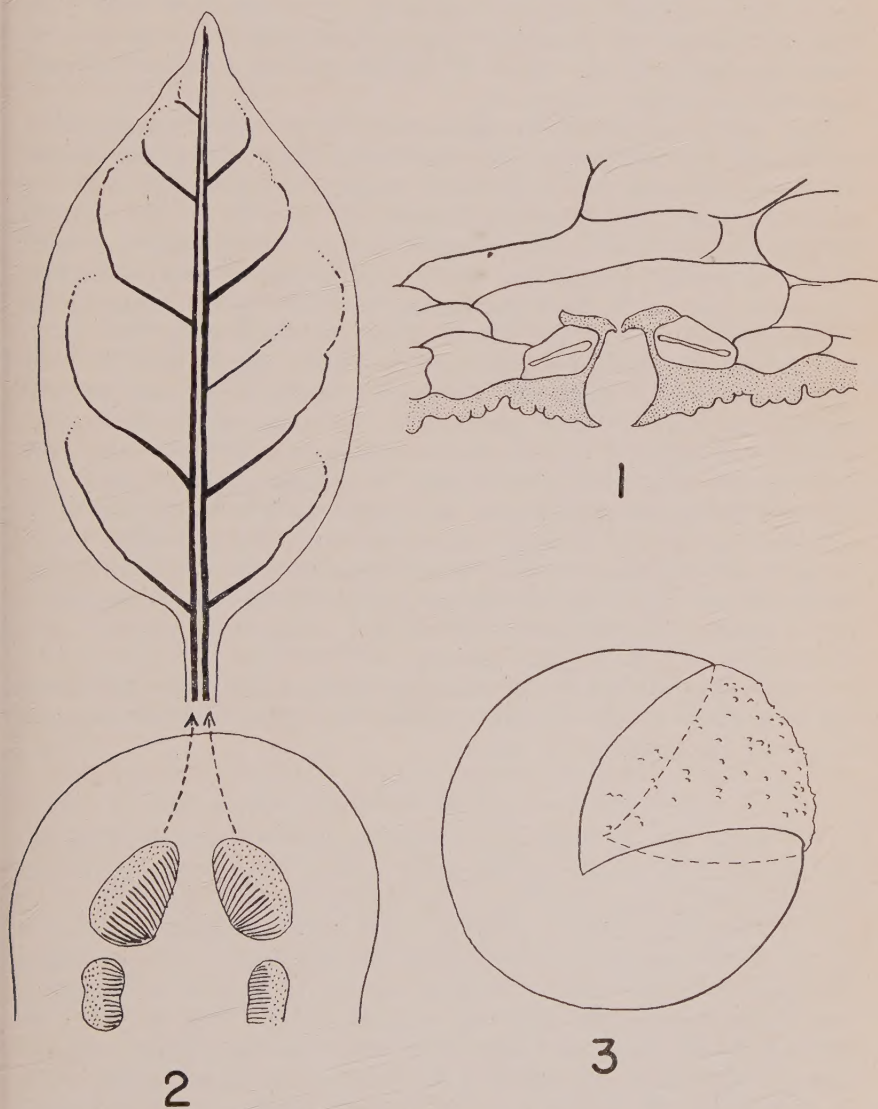
The wood parenchyma is paratracheal in distribution, *Fig. 3*, and, as frequently the case in scandent stems, tends to be more abundantly developed on the abaxial sides of the vessels. The multiseriate rays are extensive longitudinally, *Fig. 4*, having slender elongated cells on their flanks and high-celled uniseriate extensions on their upper and lower margins. The uniseriate rays exhibit evidences of phylogenetic reduction, particularly in the first-formed part of the secondary xylem, are low and composed of vertically much elongated cells.

#### THE LEAF AND NODAL ANATOMY

During early stages of the ontogeny of the vegetative shoot, the leaves are arranged in a typical decussate phyllotaxy. However, during subsequent growth of a shoot, the leaves of an individual pair may remain truly opposite or they may become sub-opposite or even widely separated by irregularities of interstitial elongation. The entire, glabrous, pinnately veined leaves are coriaceous at maturity, being provided with a thick and conspicuously striated cuticle in surface view. The relatively large



stomata of the lower surface of the leaf may have subsidiary cells oriented parallel to the guard cells ("syndetocheilic" or "rubiaceous" appearing type) or they may be surrounded by ordinary epidermal cells ("haplocheilic" type). In anticlinal sections, cut at right angles to the long



TEXT-FIGURES 1-3. *Fig. 1.* Section of a stoma from the under surface of a leaf,  $\times 690$ . *Fig. 2.* Diagrammatic representation of the transverse section of a node and the vascularization pattern of a leaf. *Fig. 3.* Mature pollen grain,  $\times 982$ .

axis of the stomata, *Text-fig. 1*, a highly characteristic pattern of cuticularization is revealed. There is a conspicuous vestibule in the thick cuticle, and the cuticular substance extends inward along the surfaces of the guard cells forming two massive plates which subtend them. There is no clearly defined hypodermis or palisade tissue in the mature leaf. More or less spherical secretory idioblasts, i.e. "ethereal oil cells," are scattered through the mesophyll, and are particularly conspicuous in young developing leaves. Many of the cells of the mesophyll contain dark-colored, phenolic substances.

Each leaf is vascularized (as are so many cotyledons of angiosperms) by two discrete strands that are related to a single gap in the eustele, *Text-fig. 2*. In other words, the nodal anatomy of *Austrobaileya* is of a *unilacunar* type. The detailed behavior of the two vascular strands fluctuates considerably in different mature leaves, even in those of a single plant. In certain of them, the two strands remain separate throughout the petiole and the costa of the lamina, each half of the lamina being vascularized by the ramifications of an independent system, *Text-fig. 2*. In other leaves, the two strands may be closely approximated or they may fuse to form a single arc, particularly in the middle and terminal parts of the mid-rib. It is significant in this connection, however, that during early stages of the ontogenetic development of leaves, there are two separate strands of procambium, subsequent approximations and localized fusions occurring during the differentiation of metaxylem or of secondary xylem and phloem. Below the node, the two foliar traces (when traced downward in serial transverse sections of the stem) remain independent of each other and become attached to two independent parts of the eustele. In other words, *the two leaf traces do not originate as a dichotomy of a single vascular bundle*.

In mature leaves, the smaller veins are jacketed by thick-walled fibres, but these fibres decrease in number toward the base of the mid-vein and commonly are absent in the petiole.

### THE FLOWER

The flower buds of *Austrobaileya* are borne in the axils of leaves and are solitary in all specimens examined by us. Those collected by Mr. Stephens, are globose, *Figs. 8-10*, the pedicels varying from 0.5 to 1.0 cm. in length, depending upon the age of the bud. The short pedicels of young flower buds bear 8 to 10 pairs of decussately arranged bracts. Subsequently during interstitial elongation of the pedicel, the bracts of one or two of the central pairs tend to be displaced. Thus, in older buds it is common to find 2 or 3 pairs of compactly and decussately arranged bracts at the base of the pedicel, 2 or 4 more or less widely spaced bracts in the middle of the pedicel, and 2 or 3 pairs of compactly and decussately arranged bracts subtending the perianth, *Fig. 9*. The penultimate and ultimate pairs of bracts are larger and more woody than the rest, *Figs. 8-11*.

The perianth, as also the inner appendages of the flower, are arranged



on the floral axis in a much compressed spiral. There is no clearly defined differentiation of the perianth into calyx and corolla. In both species of *Austrobaileya*, the outermost tepal is somewhat larger than the subtending bracts. The central tepals of the series progressively attain larger dimensions, whereas the inner tepals become reduced in size to dimensions more nearly equivalent to those of the outer members of the series, *Figs. 20-32*. The tepals of *A. scandens*, *Kajewski 1269*, are much larger than those of *A. maculata*, *White 10734*, and the innermost ones tend to be of spatulate form.

The androecium of *A. maculata*, *White 10734* as of Stephens' collection, consists of 19 to 25 members, the outer 6 to 9 of which differentiate as stamens and the remainder as staminodia. The two categories merge into one another, one or two staminodia in the transition region not infrequently bearing degenerate sporangia, *Fig. 17*. The fertile male appendages are broad microsporophylls bearing protuberant sporangia on their conspicuously concave inner surface, *Figs. 15, 34, 36*.

The fertile microsporophylls and the staminodia of *A. maculata*, *White 10734* as of Stephens' collection, are characterized by having more or less numerous and conspicuously embossed purple spots, *Figs. 15-19* and *34*. These dark-colored areas tend to be more abundant on the staminodia than on the stamens, and on the adaxial than on the abaxial surface of the fertile microsporophylls. In the case of dried herbarium material, *White 10734*, the phenolic contents of the papillate epidermal cells, *Fig. 42*, of the purple areas turn black, and the spots become strikingly embossed, evidently through excessive contraction of surrounding tissue.

The stamens and staminodia of *A. scandens*, *Kajewski 1269*, are larger than those of *A. maculata*, *White 10734*, and differ from them in both form and texture, compare *Figs. 33* and *34*. They do not exhibit dark-colored embossed spots. Nor does *Kajewski* mention the occurrence of conspicuous purple areas in his field-notes on the color of freshly collected flowers.

The fact that the flowers collected by Mr. Stephens, close to the type locality of *A. scandens*, resemble those of *A. maculata* from Mt. Spurgeon raises the question whether there actually are two distinct species of overlapping ranges. Can the striking differences in size, form, texture and structure between the flowers of *A. scandens*, *Kajewski 1269*, and those of *A. maculata*, *White 10734* and Mr. Stephens' collection, be due to different developmental stages of the flowers at time of collection? In other words, is the larger size of the flowers of *A. scandens* and of their constituent parts due to the fact that the flowers were collected at anthesis, whereas those of *A. maculata* and the Stephens' collection had not attained their final stages of expansion? In order to answer this question, we have examined a young flower bud of *A. scandens*, *Kajewski 1269*, of approximately the same dimensions as the largest flower buds of *A. maculata*, *White 10734*. The stamens and staminodia of this immature flower exhibit the same differences in form and texture as the fully developed flowers, and do not have dark-colored embossed spots.

It should be noted in this connection, however, that the only conspicuous morphological difference between the vegetative organs of *A. scandens* and *A. maculata* is in the shape of the leaves. The internal anatomical characters of the stem and leaves are similar. The leaves of 11 duplicate sheets of *Brass 18160* are of uniform elliptic to lanceolate form regardless of marked variations in size, and thus resemble those of *A. scandens*, *Kajewski 1269*. The "nitid" character of the latter collection is due apparently to over-heating during drying. The leaves of *A. maculata* are elliptic-ovate to ovate.

The staminodia of *A. scandens* and *A. maculata* are irregularly ridged or folded longitudinally, *Figs. 17-19*. As seen in transverse sections, their basal part is solid and the ridges extend in diverse directions, *Fig. 36*, whereas their apical parts are characteristically conduplicate, *Fig. 35*.

Above the insertion of the staminodia, the floral axis terminates in a broad mound on the surface of which the free carpels are borne, *Figs. 12* and *38*. In *A. maculata*, *White 10734* and in Mr. Stephens' collection, the number of carpels ranges from 6-8, but as many as 14 may be present in *A. scandens*, *Kajewski 1269*. The dorsal outline of the carpel, *Fig. 13*, is more curved than the ventral surface which is nearly straight, the style being in line with the ventral side. The carpel has a more or less extensive solid basal part, *Figs. 14* and *37*, which may possibly represent a much modified stipe. The locule, situated in the dorsally more bulging part of the carpel, contains from 8 to 13 anatropous ovules in two series, *Figs. 14, 37* and *44*.

The carpels of *Austrobaileya* exhibit extreme phylogenetic modifications of the primitive conduplicate megasporophyll of the "Tasmannia-Degeneria" type, viz. 1. closure of the carpel, 2. differentiation of a hollow style and 3. elimination of the external, paired, stigmatic crests. Closure of the ovule-bearing part of the megasporophyll has progressed, as in the *Wintera* section of *Drimys*, Bailey and Nast (2), by concrescence of the stigmatic ventral surfaces of the conduplicate megasporophyll. Although closure by concrescence is complete externally, *Figs. 36* and *44*, evidences of the suture are preserved internally by a conspicuous cleft in the carpellary wall, *Fig. 44*. This cleft is jacketed by papillate cells that function in the downward extension of pollen tubes. Similar concrescence has occurred in the constricted stylar part of the primitively conduplicate megasporophyll, *Figs. 45* and *46*, forming a tubular extension whose cavity communicates with the locule, *Fig. 37*, and is lined by a more or less papillate and glandular appearing epidermis. The upper part of the style is bifid, *Fig. 13*. Just below the level of forking, the style is typically conduplicate and open on its ventral side. The ovules are anatropous and have two integuments, the outer being thicker, *Fig. 44*.

#### POLLEN

The wall of a young microsporangium of *A. maculata* in sectional view, *Fig. 39*, shows an epidermis subtended by three layers of wall cells which



are subtended in turn by a single, or an irregularly 2-layered, tapetum. When the microspore mother cells are undergoing reduction divisions, the tapetal cells become binucleate, *Fig. 40*. During later stages, the walls and the cytoplasm of the tapetal cells become homogeneously granulate and lose cellular organization, *Fig. 41*. However, neither an amoeboid shape of the individual cells nor their migration into the cavity of the sporangium, as often happens with the periplasmodial type of tapetal organization, was seen. The nutritive layer is soon absorbed after the stage represented in *Fig. 41*.

The microspore mother cells undergo reduction divisions in a simultaneous manner and form tetrads of microspores. The thickening of the exine commences while the microspores still cling together in tetrads. This feature facilitates observation of the differentiation of the germinal furrow on the distal face of the grain. The generative cell is cut off towards the furrow-end of the grain and the pollen grains are two-celled at the time of shedding.

The mature pollen grain is spherical with a single germinal furrow running nearly from pole to pole. The exine is thick and appears to be finely pitted, occasionally 3–5 pits being arranged in variously curved lines. The external surface of the furrow is sparsely flecked with minute protuberances, *Text-fig. 3*.

#### VASCULARIZATION OF THE FLOWER

The following observations upon the vasculature of the flowers of *Austrobaileya* are based largely upon preserved specimens collected by Mr. Stephens. They have been supplemented, however, by an examination of cleared carpels and stamens from herbarium specimens of *A. scandens*, *Kajewski 1269*, and *A. maculata*, *White 10734*.

At the base of the pedicel, there are 10–14 vascular bundles arranged in four independent aggregations, *Text-fig. 4*. The parenchymatous lacunae between these aggregations of bundles correspond with the decussate arrangement of bracts on the pedicel, i.e. four orthostichies. Each bract receives a pair of strands, the individual members of the pair arising from independent systems of the eustele, *Text-fig. 4, b1–b8*.

The vasculature of the tepals is similar to that of the bracts. The distinctness of the individual members of the pair of strands is particularly clear in the bases of the outer tepals, *t1–t10*; in the inner tepals, one of the strands of the pair is either feebly developed, *t11*, or altogether absent, *t14, t15*. Within the tepal, the two strands fuse and then split into a large number of veins that vascularize the lamina.

The stamens and staminodia may show at their point of attachment either two distinct vascular strands, or a pair of closely approximated strands, or a single strand. Usually in the outer functional microsporophylls, the strands are distinctly double at least at the base, *stn 1–stn 6*, while in the inner androecial members, a section at a corresponding level usually shows a single strand, *std 5–std 11*. However, when this strand

is followed downwards in the axis, it frequently is formed by the fusion of two bundles from independent systems, *std* 9, *std* 10, etc.

When a single vascular strand enters the microsporophyll, it soon trifurcates, the lateral strands again splitting at higher levels. On the other hand, when two strands supply the microsporophyll, they dichotomize at the base of the structure and the middle two branches fuse; the lateral branches also bifurcate at a slightly higher level, *Text-fig. 5*. In both instances, the strands remain close together as far as the level of the apexes of the sporangia and then spread in a fan-shaped manner.

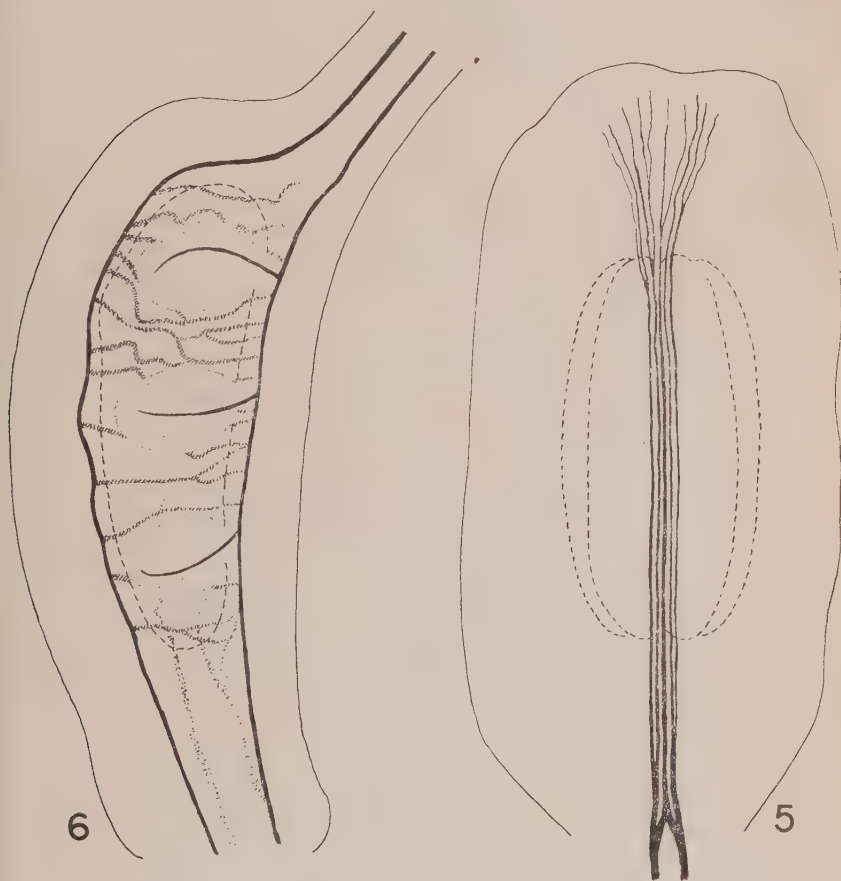
In the case of flower buds collected by Mr. Stephens, the exact number and the behavior of the strands that enter the carpels could not be deter-



TEXT-FIGURE 4. Pattern of vascularization of a flower. The axis is shown as if longitudinally cut on one side and spread in one plane. *b1-b8*, bracts; *t1-t15*, tepals; *stn 1-stn 6*, stamens; *std 1-std 13*, staminodia; *C I-C VI*, carpels. The upward terminations of strands correspond approximately to the level of insertion of the respective appendage.



mined with certainty. Even in the oldest bud examined, *Text-fig. 4*, some of the vascular strands were still in the process of differentiation (indicated by stippled lines in the figure) and it is not possible at such a developmental stage to determine their true relationship either to the floral axis or to the carpels. However, in the buds examined by us, at least three vascular strands were well differentiated in most of the carpels. These strands occupied positions corresponding to the median and ventral veins. The median vein in some cases, *C I*, showed distinct doubleness at the point of entry into the carpel and when traced downwards, the two halves fused with two independent systems of bundles in the axis. In other carpels, the two strands gave indications of ontogenetic fusion,



TEXT-FIGURES 5, 6. *Fig. 5.* Vascularization pattern of microsporophyll; broken lines denote the position of the sporangia. *Fig. 6.* Vascularization pattern of carpel; broken line denotes the extent of the locule. Vascularization is shown in one longitudinal half of carpel which is cut in the plane of conduplication.

*C III, C IV.* In still others, the median strand had lost its paired appearance and its true double nature was demonstrable only far below in the axis, *C II, C VI.*

In the case of carpels from herbarium specimens, *Kajewski 1269* and *White 10734*, the vasculature appears to be well developed at anthesis. Three of such carpels showed a distinctly double median strand at the base, the halves of which fused at a higher level in the "stipe." In others, the corresponding strand was single. Along its course through the locular part of the carpel, the median strand sends out numerous branches laterally in a pinnate manner and the branches form a diffuse net-work within the carpellary wall; the ends of the branches usually anastomose with the ventral strands, *Text-fig. 6.* The extra strands that often enter the carpel from the axis also anastomose with the system of the median strand. The ventral strands supply the ovular traces and extend to varying distances in the style along with the median strand.

Taking the vascular pattern of the flower as a whole, it appears that although there may be considerable variation among the different appendages of the same flower, and even among those of the same whorl, the paired condition of the median strand is fundamental. In those instances where the strand appears single, it is often possible to demonstrate its double nature at lower levels of the floral axis. In other words, the doubleness of the median vascular strands of the floral appendages, as in the case of the vegetative leaves of *Austrobaileya*, is *not* a result of dichotomy of a single bundle, but of the approximation of two distinct strands originating from two separate systems of bundles.

## DISCUSSION

The genus *Austrobaileya* has *monocolpate* pollen. This structural type of pollen occurs in many seed ferns, Bennettitales, Cycadales, Ginkgoales, monocotyledons and in certain families of the Ranales (sensu latu), Bailey and Nast (1), Swamy and Bailey (13). The rest of the dicotyledons, including the Dilleniaceae, have *tricolpate* pollen or phylogenetically modified types of such pollen. Thus, the occurrence of monocolpate pollen in *Austrobaileya*, coupled with the presence of "ethereal oil cells" and the absence of raphides, precludes any close relationship of the genus to the Dilleniaceae.

Among families of general ranalian affinities which have monocolpate pollen (or phylogenetically modified types of such pollen) all have "ethereal oil cells" of a characteristically similar type with the exception of the Cabomboideae and the Nymphaeoidae of the Nymphaeaceae. These secretory cells and monocolpate pollen occur in association in *Austrobaileya* which indicates that the genus belongs among this complex of families rather than among ranalian families having tricolpate pollen, viz. Trochodendraceae, Tetracentraceae, Eupteleaceae, Illiciaceae, Schisandraceae, Cercidiphyllaceae, Ranunculaceae, Berberidaceae, Lardizabalaceae or Menispermaceae.



The nodal anatomy of *Austrobaileya* is of a *unilacunar* type. Among ranalian families, having monocolpate pollen (or modified forms of such pollen) and "ethereal oil cells," this form of nodal structure occurs in the Monimiaceae, Gomortegaceae, Lauraceae, Hernandiaceae, Lactoridaceae and Chloranthaceae (*Ascarina* and *Hedyosmum*). On the contrary, the Winteraceae, Degeneriaceae, Himantandraceae, Magnoliaceae (sensu stricto), Annonaceae,\* Eupomatiaceae, Myristicaceae,\* Canellaceae, Piperaceae, and Saururaceae have dominantly *trilacunar* or *multilacunar* nodes or anomalous nodal structures, e.g. the Calycanthaceae.

Not only does *Austrobaileya* differ from the Winteraceae, Magnoliaceae, Annonaceae and other more or less closely related trilacunar and multilacunar ranalian families in its nodal anatomy and in the vascularization pattern of its leaves and floral appendages, but also in the structure of its xylem and phloem, its parenchymatous and sclerenchymatous tissues and in the form and internal structure of its floral appendages. The *totality* of general morphological, and of specific anatomical, evidence is not indicative of relationship to any of these families (i.e. except distantly as members of a common ranalian grouping), but rather to the assemblage of unilacunar families enumerated in the preceding paragraph.

Among these unilacunar families, the Monimiaceae are the most highly diversified, exhibiting numerous trends of morphological and anatomical specialization, in both their vegetative and reproductive parts, and affording significant clues regarding phylogenetic changes that occurred in the evolution of the Gomortegaceae, Lauraceae, and Hernandiaceae.

*Austrobaileya* is a vine and there is a scandent tendency in a number of the Monimiaceae. The simple, pinnately veined leaves of *Austrobaileya*, as of the Monimiaceae and Chloranthaceae, are opposite or sub-opposite and exhibit a typical decussate phyllotaxy at least during the earlier stages of the development of a shoot. The leaves of *Austrobaileya*, as of *Trimenia* and *Piptocalyx* of the Monimiaceae, *Lactoris* of the Lactoridaceae and *Ascarina* of the Chloranthaceae, are vascularized by two strands that are independent at the nodal level of the stem and are attached at lower levels to independent parts of the eustele. The stomata of *Austrobaileya*, as of many Monimiaceae, are transitional between "syndetocheilic" and "haplocheilic" appearing, and have a similar pattern of internal cuticularization, Money (7). The xylem of *Austrobaileya*, as we have shown, Figs. 5-7, has numerous transitional stages in the development of vessels from tracheids with unusually large bordered pits. Such imperforate tracheids occur in the vesselless xylem of *Amborella*, Bailey and Swamy (4). Furthermore, there are numerous transitions between tracheids and septate fibres, such as are characteristic features of many Monimiaceae. In addition, calcium oxalate is deposited in *Austrobaileya*, as in the Monimiaceae and the Lauraceae, in the form of numerous minute crystals, viz. in the form of "crystal sand" rather than as conspicuous druses or large, single, rhombic crystals.

\* Mistakenly reported as unilacunar by Sinnott (10).

The totality of available evidence from all vegetative parts of *Austrobaileya* provides no significant evidence for excluding the genus from the Monimiaceae as constituted by Perkins (8), particularly if such genera as *Amborella*, *Trimenia* and *Piptocalyx* are retained within the family. It is the flower of *Austrobaileya* and specifically its multiovulate carpels that is the chief obstacle to such a procedure. It should be noted in this connection, however, that there is such a wide range of morphological variability in the stamens, staminodes and carpels of the Monimiaceae that excessive emphasis should not be placed upon differences in the external forms of these organs in *Austrobaileya*. Furthermore, the tribes Hortonieae and Trimenieae were obviously established for florally more primitive representatives of the family, specifically for genera having free perianth members and a broadly convex or only slightly concave torus. Therefore, it would not appear to be entirely illogical to include in the family a genus which has retained broad microsporophylls and carpels in which the ovules have not been reduced to one, particularly as the vesselless *Amborella* is considered to be a member of the family.

As stated by us in a previous paper, Bailey and Swamy (4), if such genera as *Trimenia*, *Piptocalyx* and *Amborella* are to be retained in the Monimiaceae then the present concept of the family could be broadened to include *Gomortega* and *Austrobaileya*. Conversely, if a narrow concept of the family is to be maintained, then *Trimenia*, *Piptocalyx* and *Amborella* should be excluded, as well as such genera as *Gomortega* and *Austrobaileya*. However, before such decisions are attempted, it is essential to assemble more comprehensive and reliable information regarding *Gomortega*, *Austrobaileya* and the various genera of the Monimiaceae. As stated by White, in passages quoted in the introduction to this paper, it is essential to study the fruits and seeds of *Austrobaileya* before attempting to segregate the genus in an independent family. Mr. Stephens is attempting to obtain fruits and seeds for us, and, in addition, material suitable for critical embryological and cytological investigations. The separation of *Amborella* in an independent family, the Amborellaceae, Pichon (9), upon the basis of our preliminary note (3), without waiting for the publication of our detailed investigation (4), was premature and singularly unfortunate since erroneous statements regarding the ray structure and orthotropous character of the ovule were included in the brief description of the new family.

#### ACKNOWLEDGMENTS

We are indebted to the New York Botanical Garden for the loan of isotypes of *Austrobaileya scandens*, to Mr. C. T. White for material of *A. maculata*, and Mr. L. J. Brass and Mr. S. E. Stephens for their sustained efforts to obtain adequately preserved material of *Austrobaileya*, to Mr. Gualterio Loaser and Professor Augusto Pfister for their kindness in obtaining material of *Gomortega* and to Professor Katherine Esau for notes on the occurrence of companion cells in several critical genera.



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## EXPLANATION OF PLATES

PLATE I. *A. scandens*, Brass 18160. *Fig. 1.* Part of a transverse section of a large stem,  $\times 20$ . *Fig. 2.* Secondary phloem of same more highly magnified,  $\times 130$ .

PLATE II. *A. scandens*, Brass 18160. *Fig. 3.* Secondary xylem of *Fig. 1* more highly magnified,  $\times 130$ . *Fig. 4.* Tangential longitudinal section of the secondary xylem,  $\times 50$ .

PLATE III. *A. scandens*, Brass 18160. *Figs. 5-7.* Scalariform perforation plates of three vessels of different diameter,  $\times 510$ .

PLATE IV. *A. maculata*, Stephens' collection. *Figs. 8, 9.* Flower buds,  $\times 3$ . *Fig. 10.* Same, as seen from the stalk-end,  $\times 3$ . *Fig. 11.* Group of stamens and other inner appendages after the removal of the perianth,  $\times 5$ . *Fig. 12.* Group of carpels after the removal of the other floral appendages,  $\times 5$ . *Fig. 13.* Carpel,  $\times 12$ . *Fig. 14.* Same, longitudinal section passing through the plane of conduplication, to show the "stipe," locule and ovules,  $\times 22$ . *Figs. 15, 16.* Adaxial and side views of fertile microsporophyll,  $\times 8$ . *Figs. 17-19.* Staminodia; in *Fig. 17*, the structure bears degenerate sporangia,  $\times 8$ . *Figs. 20-32.* Perianth members of a single flower. The order from the outermost to the innermost runs according to the serial numbers,  $\times 1$ .

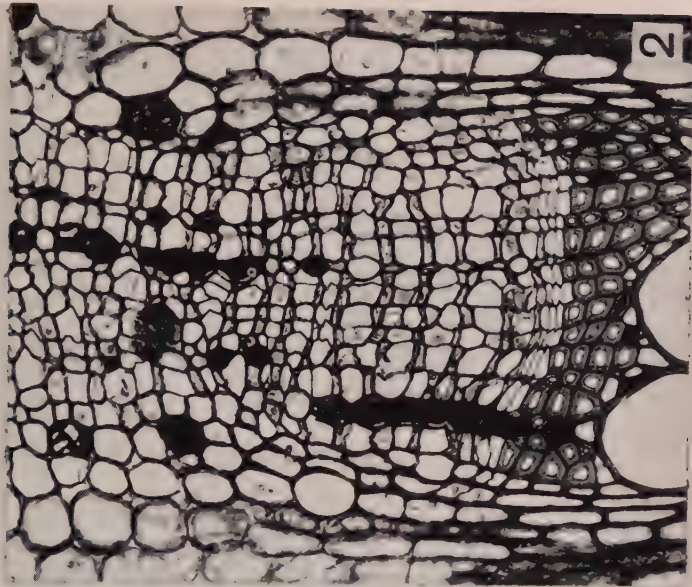
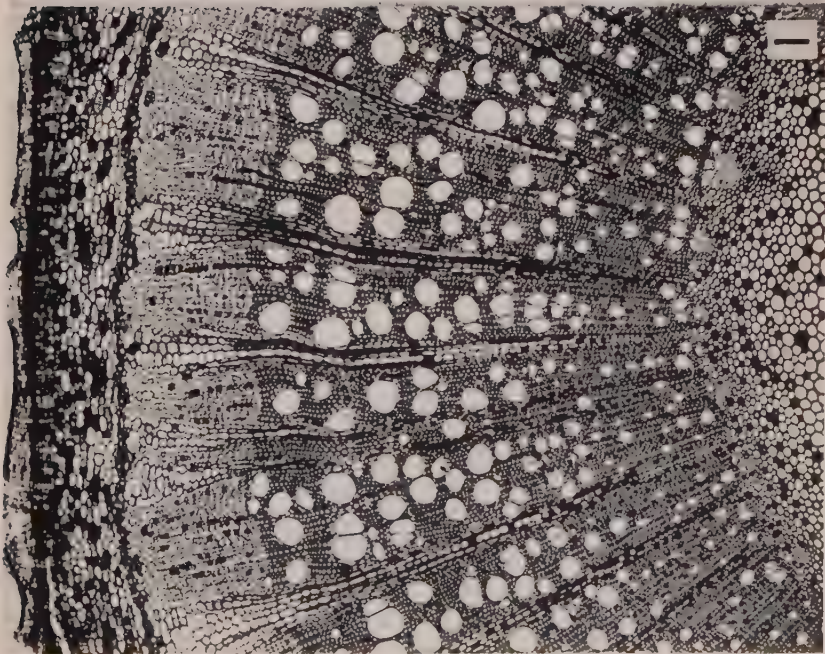
PLATE V. *Fig. 33.* *A. scandens*, Kajewski 1269. Stamen (middle) and staminodia (right and left),  $\times 5$ . *Fig. 34.* *A. maculata*, White 10734. Stamens (right and left) and staminodia (middle),  $\times 5.5$ .

PLATE VI. *A. maculata*, Stephens' collection. *Fig. 35.* Transverse section of a flower bud at the apical region,  $\times 50$ . *Fig. 36.* Same, at a central level,  $\times 50$ .

PLATE VII. *A. maculata*, Stephens' collection. *Fig. 37.* Longitudinal section of two carpels, the left hand one cut in the plane of conduplication, and the right hand one, at right angles to the previous plane,  $\times 50$ . *Fig. 38.* Longitudinal section of the floral apex,  $\times 50$ . *Figs. 39-41.* Structure of the microsporangium and tapetal organization,  $\times 130$ . *Fig. 42.* A portion of the epidermis of the microsporophyll, showing the histology of the pigment cells,  $\times 130$ . *Figs. 43-46.* Transverse sections of a carpel cut at successively higher levels,  $\times 100$ .

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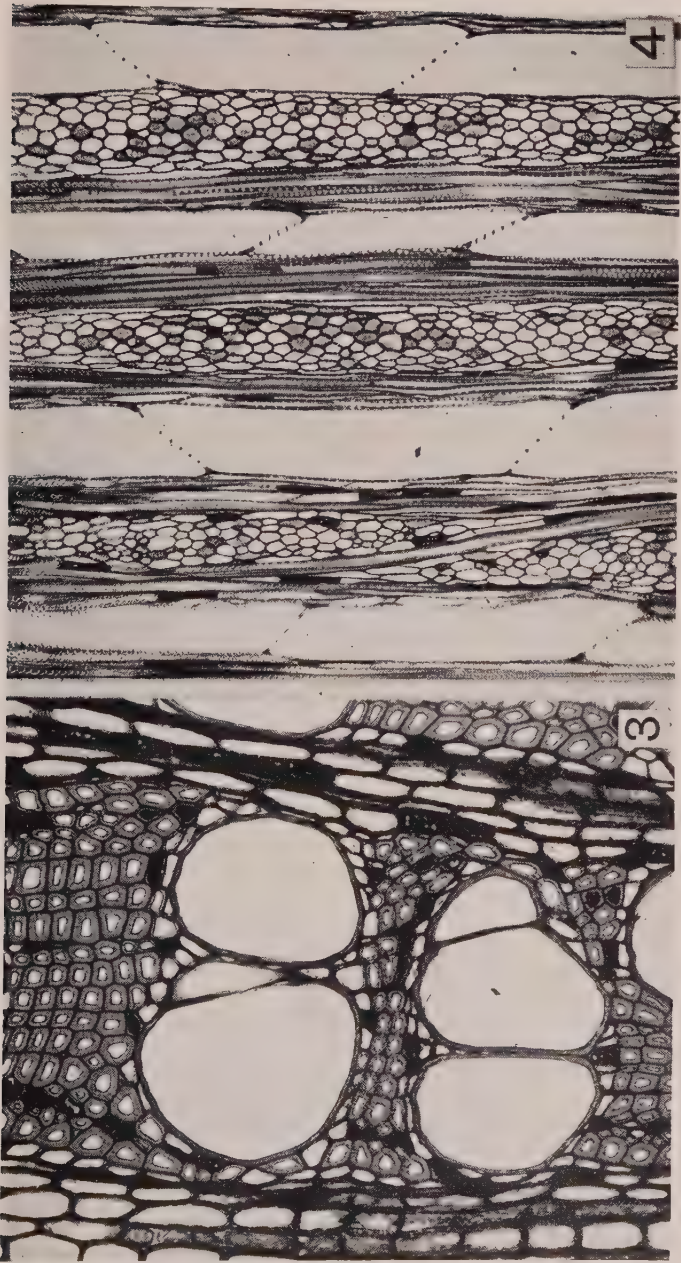




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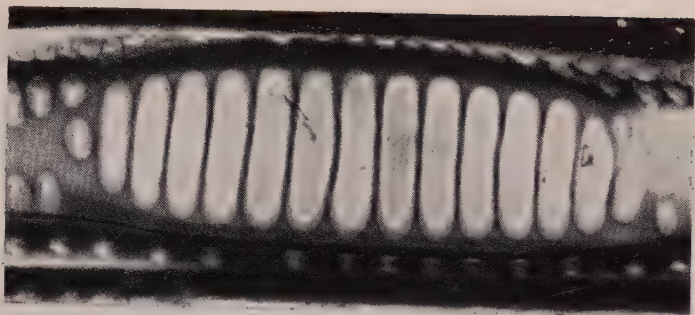




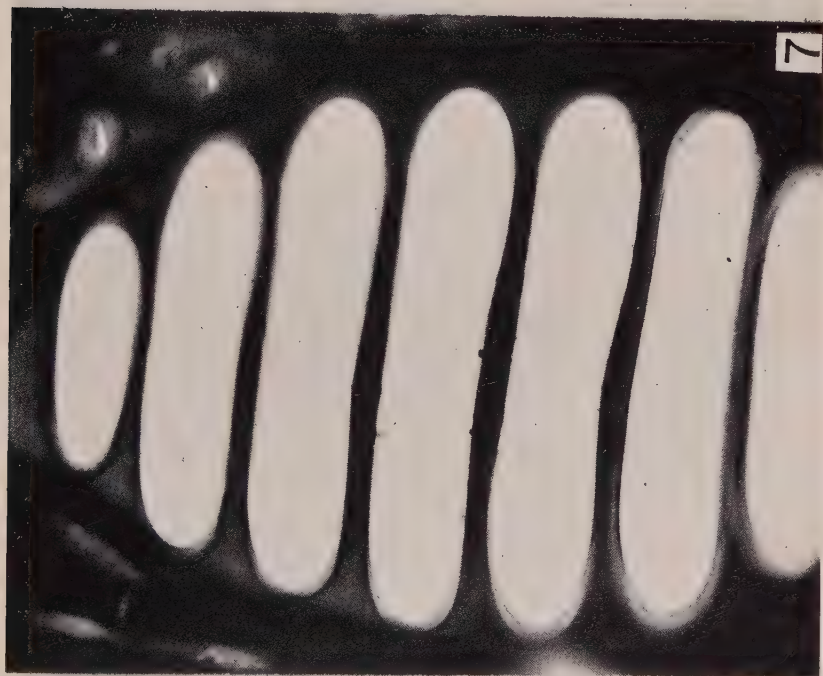
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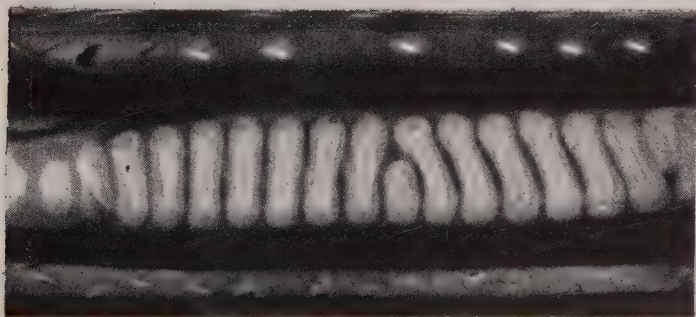


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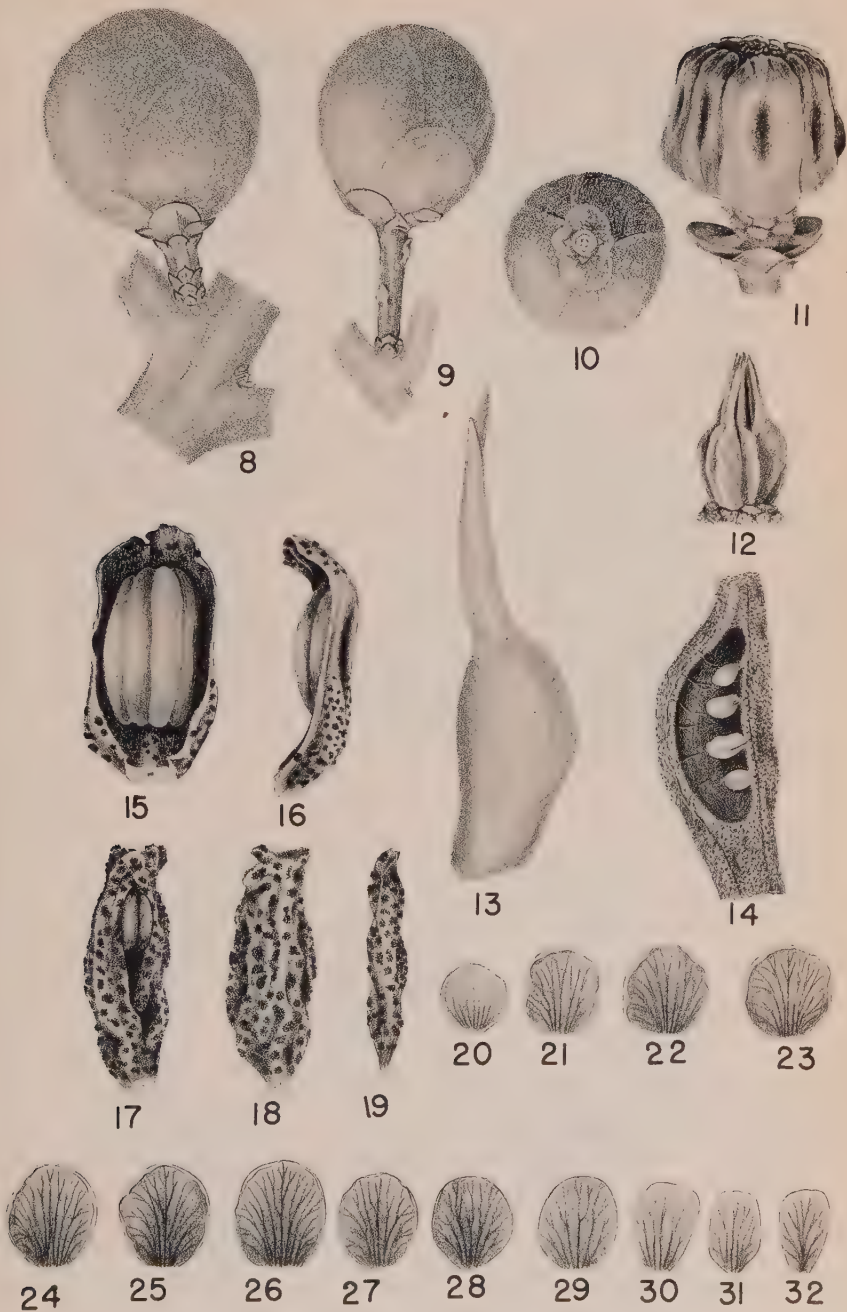
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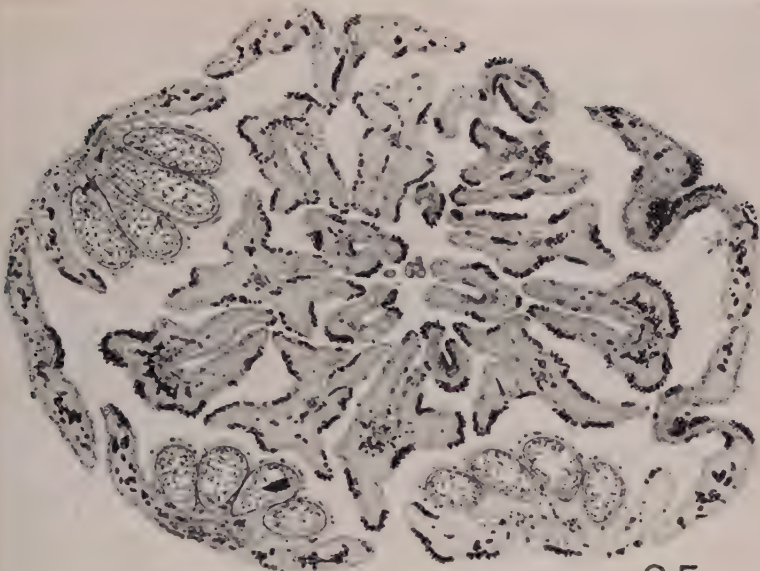




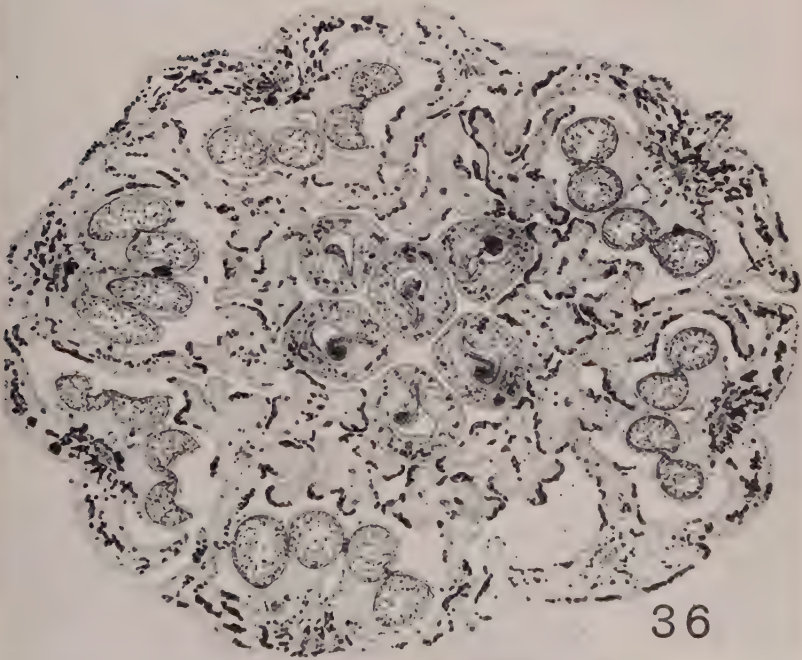






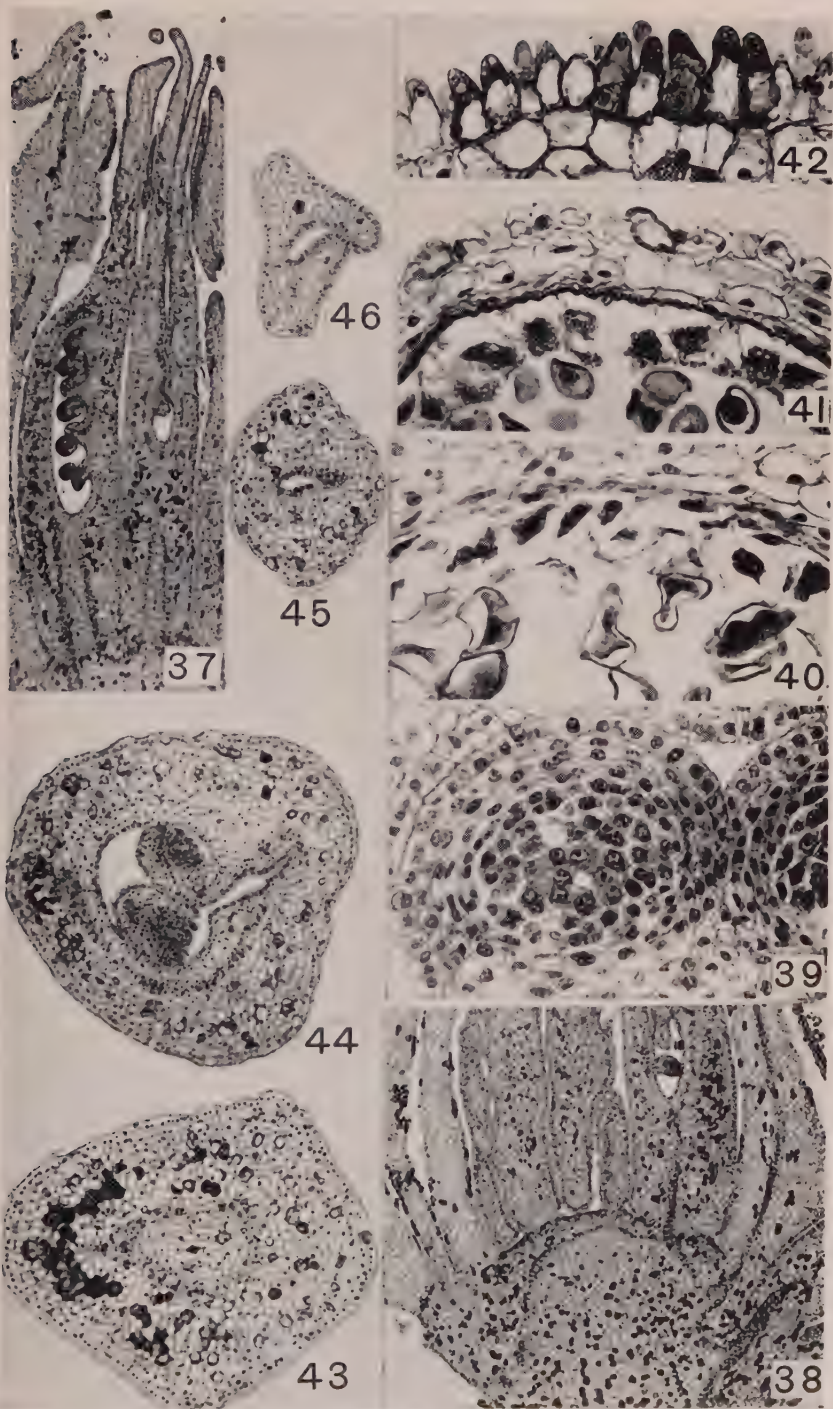


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## A NEW AGAVE FROM ARIZONA

SUSAN DELANO McKELVEY

*With two plates*

ON MAY 15, 1934, while visiting the Kaibab Plateau on the northern side of the Grand Canyon of the Colorado, Coconino County, Arizona, the writer first saw the *Agave* here described. Two plants had been collected by the Park authorities at some previous date, but their leaf-rosettes and long fruiting stalks were still intact. It was not possible to make the descent into the gorge, but a few scattered plants were discernible some distance below the rim. Flowers were promised at a later date but were never forthcoming, unfortunately.

The two plants are shown in the included photograph (McKelvey 152-12); although one was considerably smaller than the other it was undoubtedly the same species. The dimensions are from the larger plant.

*Agave kaibabensis*, spec. nov.

A *A. utahense* differt habitu solitario, non caespitoso; foliis basi rosulatis confertis, longioribus, latioribus; inflorescentiis elongatis (4.4-7.5 m. longis), basi ramiferis.

Leaf-rosette 1.4 m. in breadth, 0.7 m. in height, nearly hemispherical, with ascending and spreading straight leaves which attained 0.4 m. in length (base included). Leaf-blade concavo-convex for the entire length, usually tapered from the point of union with the base to the apex, sometimes constricted above this union, then gradually and slightly broadened to a point near the middle, thence tapered to an acuminate apex, smooth on both surfaces; terminal spine 1-1.3 cm. in length, channeled on the upper surface and decurrent along the margins of the blade for 10-15 cm.; prickles along the leaf-margins irregularly spaced at intervals of 0.7-2 cm., small, 1.6-3.2 mm. in length, curving either backward or forward following the blade-margins. Leaf-base about 15 cm. in breadth at the point of union with the stem, gradually narrowed to the point of union with the blade where about 6.5 cm. in breadth, about 10 cm. in median length. Inflorescence 4.4 m. in length over all; scape 1.4 m., inflorescence proper ca. 3 m.; the last, while spicate in general appearance, was narrowly ovoid-cylindrical, branched for the entire length, the branchlets longer and more complexly branched below than above; branchlets near the base 10-12 cm. in length, twice forked; those above gradually reduced in length and finally at the top of the inflorescence proper simple. Capsules produced in great numbers, 2.5-3 cm. in length, nearly ovoid with an acute apex and short-stipitate base, with slightly glossy, red-brown epidermis; pedicels attaining 0.7 cm. in length, enlarged at the point of union with the capsule, terete; seeds extremely abundant, small, black;

bracts near the base of the scape 18–20 cm. in length, only slightly reduced in length below the inflorescence proper, at insertion 2.5–3.8 cm. in breadth, tapered from this point to the apex, the upper portion more or less concave, the lower portion flat, with a short, very sharp, channelled red spine, tenaciously attached to the scape, eventually reflexed.

ARIZONA: Coconino County, Kaibab Plateau on the north side of the Grand Canyon of the Colorado River, *McKelvey* 4381 (Arnold Arboretum, TYPE), 4381A (Arnold Arboretum), May 15, 1934.

At first glance the plants were thought to be *Agave utahensis* Engelm., in colossal form — that species is common in northwestern Arizona and is said to occur plentifully in the Grand Canyon although the writer has not happened to see it growing there. But examination disclosed marked differences in the individual leaf, the leaf-rosette, to some extent in the inflorescence, and, important, in the habit of the plant.

When examined the leaves of the new species were dry and their margins were considerably incurled but must once have been much flatter; in form and size and in the straight, spreading habit they came close to what is found in the so-called century plant or mescal — with panicate inflorescence — and the rosette in size and near-hemispherical form also. The leaves of *Agave utahensis* and of those of its allies with prickles along the leaf-margins (and producing spicate or subspicate inflorescences) show a marked tendency to bend inward towards the center of the head, producing a spherical or near-spherical rosette. This tendency to spreading or to curving inward is not altered with the death of the plant; if anything it becomes more pronounced with drying in each instance. The leaves are also much smaller, shorter, and narrower.

*Agave utahensis* shows a tendency towards a paniced inflorescence. This has been noted by the writer more than once and has been recorded in the literature. Miss Mulford (*Agaves of the United States*, 77, 1896) states that that species “. . . so frequently approaches the panicate character, that it might be placed in the *Euagave* section with almost as much propriety as in that of the *Littaea*.” In the case of the new species the branching is more complex and not confined to the lower portion of the inflorescence proper as is usual in the better known plant.

In habit the two would seem to differ radically. The two plants of *Agave kaibabensis* which were examined showed no tendency to produce offsets, while those seen from afar in the gorge were obviously solitary rather than of clump-habit. *Agave utahensis* is caespitose, in all instances, often producing large and involved clumps.

Park officials said that near the base of the gorge flower-stalks attained 7.5 m. in over-all length; while easy to overestimate, yet, from the large specimen seen, a greater size does not seem improbable. It is not unique to find a plant growing on the walls of the gorge but not appearing above the rim — it has been observed in one species of *Yucca* certainly. It was said that the Piute Indians called the plant “Oose” (this spelling open to correction); the local name was “Yant,” the stalk of the inflorescence called a “Yant-stick” and used to prod cattle.



Unsuccessful attempts were made to locate the plant in adjacent regions, and while, from information obtained, it may occur near the lower portion of Kanab Creek where this empties into the Colorado, it is possible that the name "Yant" may be applied as well to *Agave utahensis*.

It is believed that photographs of *Agave kaibabensis* have appeared on three occasions: Once in an unsigned article in *Garden and Forest* (8: 384, fig. 53. 1895) as *Agave utahensis*; but the solitary rosette is far more suggestive in every respect of the plant under discussion. The short scape of the photograph would be abnormal for either species,—it may have been cut for inclusion, but one cannot be sure from the reproduction. The article notes the leaves as "... twelve or fourteen inches long and from two to three inches broad. . . ." and "... the slender spike . . . as three feet long, and often raised on a stem seven or eight feet high." This plant grew on "... the bluffs and cliffs which rise from the slopes of the Grand Cañon . . ." (while not entirely clear this seems to indicate the Canyon walls); it is not stated whether on the north or the south side of the river.

Next, two photographs appeared in Mr. Harold E. Anthony's interesting article published in *Natural History* (40: 719, 1937), describing the exploration of Shiva Temple, a near-island in the Canyon connected by a saddle with the north rim. The first photograph, showing only a rosette—one which might well belong in the Euagave section—is captioned: "The Mescal of Shiva is a variety of century plant with stiff, thorn-tipped foliage. The young plants grow in a compact clump." The word "clump" as used here probably refers to the dense rosette—it shows no tendency to suckering. The second photograph is captioned: "When mature the mescal, or 'yant,' sends up a tall flower stalk twelve feet or more. The Pueblo Indians used the starchy center of this stalk for food, baking it in earthen pots." The rosette is not visible in this picture, but one sees a tall inflorescence with scape longer than the flowering portion and with the inflorescence proper considerably broader below than above, although the general effect is spike-like.

The third picture of this plant has recently (1945) appeared in *This is the Place: Utah*, by Maurine Whipple. The caption is *The Grand Canyon of the Colorado*, the plate on page 204.

The name *Agave kaibabensis* indicates the plant's habitat as now known. The smaller plant of the picture is *McKelvey 4381A*. The plant, as noted, came originally from some distance below the rim on the north wall of the Canyon. The date of actual collection is not known; it must have been in the tourist season of 1933; the writer made her specimens on May 15, 1934. Her photographs 152-11, 12, and 153-1, 2 are of these plants; reproduced here is 153-2 (Pl. I).

Included, to show the different appearance of its rosettes and leaves, is a photograph (McKelvey 82-1) of *Agave utahensis* (Pl. II); the specimen (McKelvey 1655) was collected March 31, 1929, some 13 miles east of Peach Springs, Mohave County, Arizona, in the extreme northwestern corner of Yavapai County. Over much of this region the plant is plentiful, reaching certainly as far southwest as Valentine, Mohave County.

The tendency of the leaves to bend inward towards the center of the head and so form a near-spherical rosette, and the caespitose habit of the plant are apparent. The six-inch rule indicates the small size of leaf and leaf-cluster. Miss Mulford (l. c.) described the leaves of *Agave utahensis* as “. . . linear-lanceolate . . . 12 to 17 cm. long, 2–2.5 cm. wide, or larger . . .” and its inflorescence thus, “. . . scape 15 to 24 dm. high . . . upper 3 to 6 dm. floriferous; panicle narrow . . .”

#### EXPLANATION OF PLATES

PLATE I. *Agave kaibabensis* McKelvey, showing the near-hemispherical rosette of leaves and the long-branched inflorescence. Collected on the Kaibab Plateau, on the north side of the Grand Canyon of the Colorado River, Coconino County, Arizona.

PLATE II. *Agave utahensis* Engelm., showing caespitose habit. Collected about thirteen miles east of Peach Springs, Mohave County, Arizona.

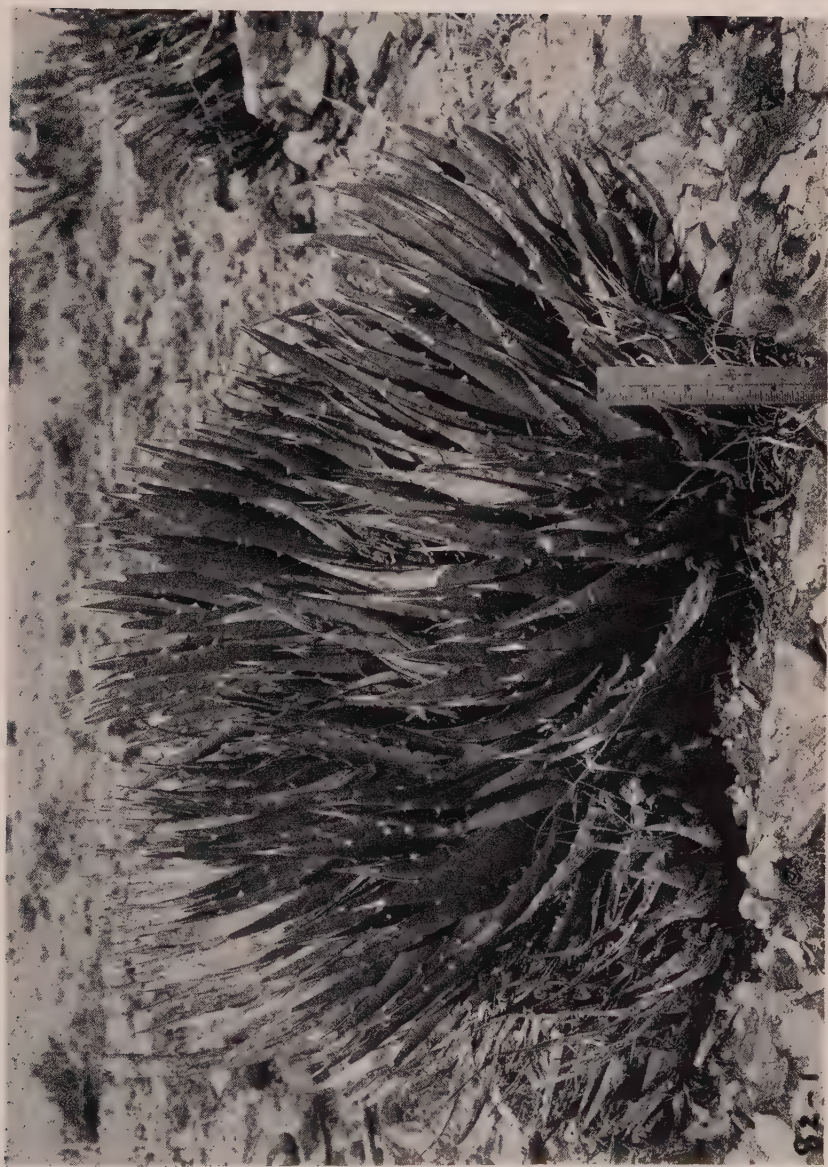
ARNOLD ARBORETUM,  
HARVARD UNIVERSITY.



AGAVE KAIBABENSIS MCKELVEY







AGAVE UTAHENSIS ENGELMANN





## A NEW GENUS OF THE ARALIACEAE

HUI-LIN LI

ON THE ISLAND OF TAIWAN (FORMOSA), there is an anomalous species of the family Araliaceae known as *Oreopanax formosana* Hayata. *Oreopanax* is otherwise an exclusively tropical American genus. Upon careful study of the ample number of specimens preserved in Formosan herbaria, I have come to the conclusion that a different genus is represented. Not being able to refer it to any existing genus, I propose a new genus under the name *Sinopanax*, in recognition of its geographical location.

The specimens cited below are those preserved in the Herbarium of the National Taiwan University except *Wilson 9734*, which is deposited in the herbarium of the Arnold Arboretum.

*Sinopanax*, gen. nov.

Arbuscula vel frutex, ramis cinereo-stellato-tomentosis vel adpresse pilosis inermibus. Folia ampla simpla longe petiolata, petiolis basi dilatatis, stipulis parum prominulis ad basin petiolorum connatis, laminis late orbicularibus obsolete 3-5-lobatis vel grosse irregulariter dentatis, subtus stellato-tomentoso et piloso dense obtectis. Inflorescentia ampla corymboso-paniculata terminalia laxa erecta aperta, ramis alternis angulo obtuso divaricatis. Florum capitula sublobata, capitulis florum pedunculatis remote instructis, bracteolae florum sub singulo flore 3-nae, 1 subtendente majore, 2 lateralibus minoribus oppositis. Calyx margine minute dentatus, basi exarticulatus. Petala 5, aestivatione valvata, caducissima. Stamina 5, filamentis brevissimis; discus explanatus. Ovarium 2-loculare, loculis 1-ovulatis, stylis 2 brevibus liberis erectis, stigmatibus terminalibus. Fructus late globosi, abortu 1-spermi drupacei, stylis persistentibus valde recurvis. Semina ovoideo subtriquetra, albuminibus ruminatis.

TYPE SPECIES: *Oreopanax formosana* Hayata.

One species, Taiwan (Formosa), China.

*Sinopanax formosana* (Hayata), comb. nov.

*Oreopanax formosana* Hayata, Fl. Mont. Form. 108, pl. 14. 1908, Icon. Pl. Form. 2: 61. 1912, Gen. Ind. Fl. Form. 33. 1916; Kanehira, Form. Trees 280. 1917, rev. ed. 524, f. 484. 1936; Nakai in Jour. Arnold Arb. 5: 19. 1924; Masamune, Short Fl. Form. 155. 1936.

CHINA: Taiwan: Kao-hsiung, Chi-shan, *Suzuki-Tokio 20930*; Akohuzi, *E. Matuda 1404*; Karenko, Nankotaizan, *Suzuki-Tokio, N. Fukuyama, & H. Shimida 17547*; Hannoki, Heito, *S. Suzuki 11127*; Arisan, Utsuoko, *S. Suzuki s. n.*; Ako, Mt. Buwi, *S. Sasaki s. n.*; Arisan, *E. H. Wilson 9734* (Arnold Arboretum).

A small tree or shrub, in dry sunny places, on landslides or in open forests at high altitudes of over 2000 meters. Endemic.

For *Oreopanax formosana*, Hayata originally cited five collections: *N. Konishi 34A*; *G. Nakahara s. n.*; *T. Kawakami & U. Mori 1709*,

1871, and 1914. Among these, three are represented by duplicates in the Herbarium of the Forestry Institute of Taiwan and carry the herbarium numbers as follows: *Kawakami & Mori* 18506, *Mori* 18505, and *Konishi* 18511. These have also been seen.

*Oreopanax* is an araliaceous genus of the tropics of the western hemisphere. Two species have been credited to eastern Asia, the only records of the genus outside America. One of them, *Oreopanax chinense* Dunn (Jour. Linn. Soc. Bot. 35: 500. 1906) is a species with digitately compound leaves, described from southern Yunnan. It belongs to the group of species of *Schefflera* with capitate flowers and is now known as *Schefflera chinensis* (Dunn) Li (Sargentia 2: 17. 1942). Another species, *Oreopanax formosana* Hayata, a species with simple irregularly and shallowly lobed leaves and described from Formosa, seems to represent a distinct genus. The occurrence of *O. formosana* Hayata in Formosa has often been referred to as a very anomalous case of distribution in the flora of the island, the species being the only representative of the otherwise exclusively tropical American genus. This view thus needs revision.

This Formosan species, here designated as representing the type of a distinct genus, *Sinopanax*, resembles *Oreopanax* in the simple leaves, sessile and capitate flowers, ruminant endosperm, and the presence of three bracts under each flower. However, there are some fundamental differences between the two. The ovary of *Oreopanax* is generally 5-celled, and the flowers are polygamo-dioecious or more rarely polygamo-monoecious. In this Formosan plant the ovary is 2-celled and the flowers are hermaphroditic. There are two styles, and these are so extremely short that the stigmas can actually be called sessile. In *Oreopanax* the style is rather long and bears a flat stigma.

This new genus of Formosa seems to be related to, but evidently not congeneric with *Schefflera*. The species of *Schefflera* have hermaphroditic flowers. Occasionally simple palmately lobed leaves and capitate flowers characterize some of its species. *Schefflera*, however, differs from the Formosan plant in having a 5-7-celled ovary and uniform or very rarely slightly ruminant endosperm. The relationship of this Formosan genus is probably closer to *Brassaioopsis* than to *Schefflera*. In *Brassaioopsis* the ovary is 2-celled, the leaves are either palmately lobed or digitately compound, and the endosperm is either ruminant or uniform. But in *Brassaioopsis* the flowers are polygamous and not capitate, and the two styles, either long or short, are distinctly united. *Sinopanax* is also distinct from both *Schefflera* and *Brassaioopsis* in the presence of three small bracts, one larger than the other two, under each flower.

It thus seems that this Formosan plant is not acceptable to *Oreopanax*, *Schefflera*, or *Brassaioopsis*. Nor can it be assigned, to the knowledge of the writer, to any other tropical Asiatic genus of the family. In order to ascertain its phylogenetic and geographic significance, it is thought best to designate a separate genus for its accommodation.

NATIONAL TAIWAN UNIVERSITY,  
TAIPEI, TAIWAN, CHINA.

THE GENUS *ILEX* IN CHINA \*

SHIU-YING HU

*With nine text-figures*

## INTRODUCTION

IN THE SPRING OF 1943, with Prof. W. F. Chu, Head of the Department of Forestry, College of Agriculture, University of Nanking, and a class of Agricultural students of Chuan-kang College of Agriculture and Engineering, I made a collecting trip to the charcoal manufacturing area at the White-water River, Pun-hsien, Szechuan, China. In the dense mixed forest I found an attractive dioecious evergreen shrub with large dark green lanceolate leaves, shiny cherry-red fruit, and chocolate-colored small flowers. The beautiful combination of colors, the complete representation of staminate and pistillate flowers and fruit, the rarity of the plant in the forests of West China, together created in me a strong interest in the plant. In my ignorance of the Aquifoliaceae I mistook it for an *Ilex* presumably a new species. Hence, I collected many sets of the plant, treasuring it highly and holding it for the time when I could identify it.

In the summer of 1944 I was asked to represent the Chengtu Chapter of the Science Society of China at its twenty-third annual meeting in Pai-pei, Chungking, China. I took this opportunity to be my precious chance to identify the specimens that had been accumulating in the herbarium of the West China Union University, the institute where I was working. Those specimens which I considered unusual I carried along, hoping that I might identify them in the well-equipped herbaria of the Biological Laboratories of the Science Society of China and that of the Academia Sinica, two neighboring refugee institutions then at Pai-pei.

After the meeting I stayed on to work at the Biological Laboratories, and starting with the White-water River shrub I worked through the Aquifoliaceae, but was doomed to disappointment. First, there was nothing that would match my specimen, and secondly, the Aquifoliaceae in that herbarium were in a discouraging condition. About half of the mounted sheets were not named. With three months of vacation ahead of me, and at the suggestion and with the encouragement of Prof. S. S. Chien, Acting Director of the Biological Laboratories, and others on the staff, I made a start in the clarification of the Chinese Aquifoliaceae. At that time I could not foresee the trouble that lay before me.

Life during those three months will provide me always with precious memories. I boarded in a mediaeval-type bungalow and worked on the

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top floor of a poorly built and unshaded building under the blistering summer sun in one of the two hottest areas of China. In this environment I embarked on the study of the Chinese Aquifoliaceae. Though living in the age when atomic energy had been utilized by man, my equipment was no better than that used by Linnaeus. All that I had, besides the specimens and literature, were a hand-made tripod-lens, a ruler, two self-fashioned dissecting needles, and at night a rapeseed-oil lamp lit by three pieces of pith from *Juncus effusus*. My study gradually became so intensified that I found myself working fourteen or sixteen hours daily. Perspiration and the blood of crushed mosquitoes punctuated my three hundred pages of manuscript.

On my way back to Chengtu I stopped at the National Central University in Shih-pai, Chungking, then a refugee institution, and asked for the aquifoliaceous material in the herbaria of the Department of Biology of the College of Science and the Department of Forestry of the College of Agriculture. In Chengtu I worked on the material of the Herbarium of the University of Nanking (which had been transported to this place during the war), and the Herbarium of the Department of Biology, College of Science, National Szechuan University.

In the autumn of 1946 I came to the Arnold Arboretum to study taxonomy with Professor E. D. Merrill. One day I asked him about a topic for my thesis. After a good smile he said, "Well, since you have delved into the problem of *Ilex*, you might as well go more deeply and come out of it gallantly." Hearing this, a false joy of holding a secret fell upon me, for I then thought that I might use my old manuscript, emend it, make some additions, and use it as a thesis. At that time I still considered species to be definite entities and so readily separable one from another.

I started with the material in the Arnold Arboretum and the Gray Herbarium. Dr. A. C. Smith, then Curator of the herbarium of the Arnold Arboretum, borrowed the Chinese Aquifoliaceae from the U. S. National Herbarium of the Smithsonian Institution for me. Prof. Merrill, on a recent trip to Europe, procured either as a loan or a gift, isotypes, photos, and fragments of types from the herbaria at Kew, the British Museum, and the Rijksherbarium at Leiden. Later he obtained isotypes and other authentic specimens from the herbarium of the Muséum National d'Histoire Naturelle, Paris, France, the National Taiwan University of China, and the Botanical Institute of the University of Tokyo, Japan. Through Professor Johnston I received photographs and the loan of types from Cambridge University and from the British Museum and later the Asiatic types of *Ilex* from the New York Botanical Garden. In September, 1948, Professor Merrill made it possible for me to take a trip to the last mentioned institution so that I might examine the Chinese Aquifoliaceae in the herbarium, and as a result of this trip I borrowed about 400 sheets of *Ilex* for critical study. As I examined more and more material, my confidence in the classification of the Chinese Aquifoliaceae waned. First, the study weakened my concept as to the nature of species. So much variation

appeared within a species, and such a gradual change from one species to another was exhibited, that I found it very difficult to determine definite specific limitations. I found that my original manuscript prepared in China was far too premature and that even Loesener's classical monograph on the Aquifoliaceae was, in part, based on characters far too superficial.

Besides those whom I have mentioned in the foregoing paragraphs and all the curators of the herbaria that have facilitated my studies, I would like to take this opportunity to express my special thanks to Professor E. D. Merrill who assigned me the problem, who has watched all my efforts, and has enjoyed with me the completion of the work; to Professor I. M. Johnston, the present sponsor of my thesis, for helpful criticisms and suggestions; to Dr. C. E. Kobuski, Curator of the herbarium of the Arnold Arboretum, for his patience in answering all my questions and, in turn, questioning me wisely, and for the pains he took in going over my manuscript; to Professor Karl Sax, Director of the Arnold Arboretum, for all the facilities he has provided in this study; and to Dr. Lily M. Perry, Professor A. Rehder, and the whole staff of the Arnold Arboretum for their willingness and readiness to give any help that a stranger in this New Land might need. A large part of this work has been done under the Julia George fellowship granted to me by Radcliffe College. To the administrators of that college, especially to Dean Bernice Brown Cronkhite, I wish to extend my deep appreciation.

In the paper I have used the terms East China, Central China, West China, Southwest China, and South China rather loosely. These names were taken in the common sense, as they are used in general literature and the spoken language. There is no definite geographical area assigned to each. In order to give my reader a picture as to the locality to which each name approximately refers, I find it necessary to define them. If one takes Ichang as a center, a circle with a radius of 400 miles will cover approximately the area between Lat. E. 105–115° and Long. N. 127–133°. This I term Central China. East of this area is East China and west of this area is West China. North of Central and East China is North China. South of Central and East China is South China. North of West China is Northwest China and south of West China is Southwest China. Northeast China in general usage refers to Manchuria.

### HISTORY

In Linnaeus' *Species Plantarum* (1753), one Asiatic species was described, *Ilex asiatica* from "India." Because of the very short description, and because no type was preserved, its status cannot be determined. Linnaeus knew no Chinese species of the genus.

The first botanist to publish a species of Chinese Aquifoliaceae was John Sims. In 1819 he described the staminate plant of *Ilex chinensis* from a living plant introduced into England. Fourteen years later Hooker and Arnott (1833) described *Ilex pubescens* and *Prinos asprella* (*Ilex asprella* [Hook. & Arn.] Champ.) from South China, and in 1850, seventeen years

later, Lindley and Paxton described two plants introduced by Fortune into England and named them *Ilex cornuta* and *Ilex microcarpa* (= *Ilex rotunda* Thunb. var. *microcarpa* [Lindl. & Paxt.] S. Y. Hu). About the same time (1852), Bentham, working on the flora of Hongkong, described *Ilex cinerea*, *Ilex graciliflora*, *Ilex memecylifolia*, and *Ilex viridis* from that island. These species were treated again (1861) in his *Flora Hongkongensis*. Maximowicz (1881) in his monographic work on *Ilex* treated twenty-two eastern Asiatic species, many of which occur in China. Forbes & Hemsley (1886), in their *Index Florae Sinensis*, enumerated nineteen species, one of which, *Ilex ficoidea*, was new.

Loesener in 1900, in Diels' *Die Flora von Central-China*, discussing the Aquifoliaceae of the area concerned, listed seventeen species and varieties that occurred there. Three of the specific epithets used, as well as five names of lower rank, were *nomina nuda*. In his monumental *Monographia Aquifoliacearum* published the following year he treated forty-eight species and eighteen varieties native to China. Ten of these species and fourteen of the varieties were described as new. In the supplement to that monograph (1908) he added notes on nine Chinese species and four varieties. He also described nine other new varieties or forms from China. In 1911, in Sargent's *Plantae Wilsonianae*, he added records for twenty species and described three from West China as new.

H. Léveillé (1911–1915) created much trouble for later botanists with an interest in Chinese plants. In his work on *Ilex* he was especially confusing. He described *Ilex chinensis* Sims at various times as a new species of *Celastrus*, of *Symplocos*, of *Embelia*, and of *Callicarpa*. Likewise he mistook *Ilex suaveolens* (H. Lévl.) Loes. for a new species of *Celastrus*, *Ilex metabaptista* Loes. for a new species of *Maesa* and of *Embelia* and *Ilex macrocarpa* Oliv. for a new species of *Diospyros* and of *Celastrus*.

Rehder, in his *Ligneous Plants of Northern China* (1926), recorded *Ilex pernyi* Franch. from Central and West China and *Ilex yunnanensis* Franch. from West China. An important contribution to the study of *Ilex* was his identification, in 1933, of three species and four varieties improperly classified by H. Léveillé.

Among the papers I have reviewed in the past six years, there is only one which is devoted solely to the *Ilex* of China, and this includes only a portion of the country. This paper was published by Comber in 1933. In it he published five species and seven varieties or forms from Southwest China. He also added new records to nineteen species and five varieties. Handel-Mazzetti in the same year treated nineteen species and eight varieties of *Ilex* in his *Symbolae Sinicae*. One of these species and four of the varieties were new.

In 1937, Chen, in his voluminous *Illustrated Manual of Chinese Trees and Shrubs*, gave detailed descriptions of eleven species of *Ilex*. Seven of them were illustrated, with most of the drawings reproduced from sources not given. But the information concerning each species was quite original and useful.



MORPHOLOGICAL CHARACTERS AND THEIR BEARING  
ON CLASSIFICATION

The genus *Ilex* is the only representative of the family Aquifoliaceae in China. The morphological characters discussed below accordingly refer to the genus *Ilex* only.

I. **Habit:** The Chinese members of the genus *Ilex* are either evergreen or deciduous trees or shrubs. The largest of them are trees of the coastal forests. Plants of *Ilex rotunda* Thunb. often attain a height of twenty meters, with a smooth gray trunk of half a meter in diameter. The smallest species are the shrubs of the Yunnan alpine region. Plants of *Ilex intricata* Hook. f. and *Ilex perryana* S. Y. Hu are creeping, with upright branchlets only 20–70 cm. high. Unless the contrast is very great and is reinforced by good supplementary characters, the differences in habit have not been considered of much importance in this paper. This is because our knowledge of the habit of the plant depends largely on the reports given by the collectors of specimens in the herbarium. These reports are not always dependable and are often entirely lacking. One collector may call a plant a large shrub while another may call it a small tree, depending upon the collectors' judgment, experience and knowledge of the plants. Moreover, in China the vegetation has been so disturbed that a plant with a tree habit may have been so repeatedly cut by fuel gatherers that it has assumed a shrubby habit.

II. **Branchlets:** *Ilex* species are generally slow-growing plants. A small twig usually represents two or more years of growth. In general, the amount of the annual growth of a twig is 5–15 cm. The current year's growth is usually angular. Older growths are terete or subterete.

1. **DIMENSION:** Though environmental conditions often produce variations in the diameter of the branchlets of a species, in general the dimension attained by the branchlets is correlated with the various series into which the genus is divided. The Prinifoliae have slender, much ridged current year's growth which never exceeds 2 mm. in diameter and with the terminal buds absent or very poorly developed. On the other hand, the Lauroilex have stout branchlets 3–4 mm. in diameter with well-developed terminal buds.

2. **ELONGATED AND ABBREVIATED SHOOTS:** The presence or absence of the abbreviated shoots is of subgeneric interest in *Ilex*. There are no abbreviated shoots in the evergreen species. On the other hand, the deciduous species largely possess this feature. The abbreviated shoots are 0.5–5 cm. long, densely covered by persistent bud-scales and scars of former inflorescences or leaves. It appears that there is a correlation between the presence of abbreviated shoots and the lenticels on the current year's growth of the elongated shoots, for both of them are characteristic of most members of the subgenus *Prinos*.

3. **LENTICELS:** The lenticels of the evergreen species of *Ilex* are usually absent on the first, second, or even the third year's growth. They are

small, inconspicuous, circular, or sometimes coalescent. Those of the deciduous species are usually conspicuous even on the current year's growth. They are elliptic, white, and elevated on the second year's growth.

4. **TERMINAL BUDS:** The members of the genus *Ilex* exhibit a very interesting variety of terminal buds. Some of them, like *Ilex atrata* W. W. Sm., have large ovoid buds up to 1 or 2 cm. long with thick coriaceous densely ciliate scales. Others, like *Ilex kobuskiana* S. Y. Hu and *Ilex salicina* Hand.-Mzt., have narrowly conic acute buds with such loose scales that the buds look naked. There are still others, like the *Prinifoliae* and the *Hanceanae*, that seldom have any terminal buds. In general, the presence or absence of the terminal buds, their shape and size, are often of serial significance. For example, the *Prinifoliae* possess no terminal buds, the *Hanceanae* have poorly developed ones, the *Sideroxyloides* have thin buds with loose scales, and the *Hookerianae* have very well developed terminal buds.

5. **INDUMENTUM AND EXCRESCENT GROWTH:** Most species of *Ilex* have smooth, glabrous, or pubescent branchlets; the hairs are always simple and straight. In general the hairs are very minute and sparse. This I call puberulous. When the hairs are long enough to be seen by the naked eye, they are, with the exception of a few species like *Ilex pubescens* Hook. & Arn. and *Ilex aculeolata* Nakai, ferruginous in color. Since the variation in the density of the hairs in a species is often very gradual, unless it is aided by other characters pubescence has been considered of minor importance in this work.

There are three species of *Ilex* occurring on the high mountains of southwestern China and eastern Himalaya, *Ilex delavayi* Franch., *Ilex intricata* Hook. f., and *Ilex nothofagifolia* Ward, that have rugose or warty branchlets. In general, these branchlets appear ochraceous and corky. This excrecent growth is denser on the current year's growth. It varies from merely pliciform ridges in *Ilex delavayi* to so dense a covering of distinct warts in *Ilex nothofagifolia* that the current year's growth appears like a thin pipe-cleaner. Such excrecent growths form a very convenient means of distinguishing species.

III. **Leaves:** The size, shape, margin, and texture of the leaves of *Ilex* have always been used as major features in the classification of its species. Needless to say, the use of these characters has been over-emphasized by many authors. It is one of the reasons why so much confusion exists in Loesener's monograph. For example, because of their agreement in the number of the pyrenes, the nature of the endocarp, the inflorescences, the type of the flowers, and the glandularly punctate leaves, *Ilex crenata* Thunb. and *Ilex viridis* Champ. ex Benth. are very closely related species. Yet because of differences in the size of the leaves and their relative thickness, Loesener placed the former species in the *Paltoria* and the latter in the *Aquifolium*.

1. **DURATION:** The duration of the leaves, whether evergreen or deciduous, varies in association with other characters and is useful in sub-

generic, sectional, or serial diagnosis. All the members of the subgenus *Prinos* have deciduous leaves. In the warm temperate regions like the Chengtu Plain, the leaves of those deciduous species appear with the flowers in mid-April. For six or seven months they persist on the tree and fall in October or November. In the warmer regions, like Canton, the leaves of the deciduous species appear a month earlier.

The leaves of *Lioprinus* rarely remain on the second year's growth. They are like many broad-leaved evergreen trees of the Lauraceae in that the older leaves fall soon after the terminal buds unfold in the spring. Leaves of the various species of the *Dipyrenae* are the longest-lived ones in *Ilex*. Many of them retain leaves on the third or even the fourth year's growth.

2. TEXTURE: The Chinese species of *Ilex* exhibit considerable variation in the texture of the leaves. In the section *Aquifolium* are found leaves of the thick-coriaceous type. Many of them, like the leaves of *Ilex latifolia* Thunb., have shiny glabrous surfaces. Some of them, like *Ilex elmeriana* S. Y. Hu, have such thick leaves that the lateral nerves are obscured. A very few of them, like *Ilex perryana* S. Y. Hu and *Ilex intricata* Hook. f., due to greatly impressed veinlets, have rugose upper surfaces.

The chartaceous leaves of the series *Hookerianae* present another variation. Most of these leaves are opaque, with evident lateral nerves. Distinctive are the membranaceous leaves of the subgenus *Prinos*. Most of these leaves are large, with prominent veins. In *Ilex tsoii* Merr. & Chun the veinlets are so prominent that the leaf-surfaces are marked with distinct minute areolae.

Though the texture of leaves is usually greatly influenced by environmental factors, it can be a useful character in defining subgenera and sections. For example, the subgenus *Prinos* is characterized by membranaceous or chartaceous leaves, the *Denticulatae* by coriaceous leaves, and the *Lauroilex* by large, entire, thick-coriaceous leaves.

3. SIZE AND SHAPE: The largest leaves of the genus are found in *Ilex dolichopoda* Merr. & Chun, and the smallest in *Ilex intricata* Hook. f. This variation is from 20 cm. in length in the former to 1 cm. in the latter. Extreme cases, however, are few. In the majority of the species the leaves vary normally from 2 to 8 cm. in length. In shape they vary from sub-orbicular, as found in *Ilex nothofagifolia* Ward, to linear-lanceolate, as found in *Ilex fargesii* Franch., obovate or obcordate as in *Ilex tutcheri* Merr., or ovate as in *Ilex macrocarpa* Oliv. *Ilex cornuta* Lindl. & Paxt. is unique in having subquadrangular leaves. The evergreen species usually possess leaves elliptic or oblong-elliptic in outline, while in the deciduous species the leaves are ovate or ovate-elliptic.

Environmental conditions and the age of the plant are factors which influence very much the variation in size and shape of the leaves. A vigorous offshoot of a shrub may have leaves 2-3 times as large as the normal leaves. Furthermore, the leaf shape is often affected by the position of the leaves on the branchlets. Often, upwards from the base of the branchlet, the leaves gradually change in width; thus one finds ovate leaves near the base and elliptic or even lanceolate leaves toward the apex of a branchlet.

Only when there is a sharp contrast in other characters between two species may the size and shape of the leaves be used as distinguishing characters. For example, *Ilex dolichopoda* Merr. & Chun and *Ilex kobuskiana* S. Y. Hu both have punctate leaves. The former has leaves 18–25 cm. long and the latter leaves 4.5–9 cm. long. This difference, reinforced by differences in the length of the fruiting pedicels, clearly distinguishes the two species. Mere size of the leaves alone cannot be used as a specific character.

4. APEX AND BASE: In the leaf apices of the Chinese *Ilex* species, nearly all the common variations are found. The apex may be: (1) long-caudate and acute; (2) caudate and obtuse; (3) acuminate and serrate; (4) short-acuminate and retuse; (5) obtuse and retuse; (6) obcordate; and finally the extreme (7) tricuspidate and spinose. The last-mentioned apex, although extreme, is probably the best known and the one most associated with the genus by the general public.

Both the apex and the base of the leaves of a species vary with the size and shape of the blade and with the position of the leaves on a branchlet. The leaves on the lower portion of a twig may be ovate with rounded bases and acute apices, while those of the apical portion of the same twig may be elliptic with obtuse bases and acuminate apices. This is the case in *Ilex tsoii* Merr. & Chun and *Ilex macrocarpa* Oliv. For this reason, the shape of the apex and the base cannot be used alone even for varietal differentiation. Nevertheless, when associated with other characters, they are the most obvious characters to employ in the differentiation of species, or even in characterizing series. For example, *Ilex venulosa* Hook. f. is differentiated from *Ilex omeiensis* Hu & Tang by its caudate apex and its cymose inflorescences. Likewise, the series *Longecaudatae* is characterized by the small fruit, entire leaves, and caudate or acuminate leaf apices.

5. MARGIN: Over half of all the species of Chinese *Ilex* possess leaves with serrate or crenate margins. The teeth may be fine and aristate as in *Ilex pubescens* (Hook. & Arn.) Champ. ex Benth. and *Ilex serrata* Thunb. var. *sieboldi* (Miq.) Rehd., coarse and remote as in *Ilex intermedia* Loes. var. *fangii* (Rehd.) S. Y. Hu, or crenulate and inconspicuous as in *Ilex ficoidea* Hemsl. About thirty-seven per cent of the species have entire leaves. The remaining nine per cent have spinose leaves. Again, the margin of the leaves in a species may vary with the age of the plant. In species such as *Ilex cornuta* Lindl. & Paxt., *Ilex corallina* Franch., and *Ilex dipyrrena* Wall., in developing from the juvenile stage to maturity the margin of the leaf changes from spinose to subentire or entire. For this reason the margin alone should not be used even for varietal differentiation. However, when the margin is used as an auxiliary character, it is a very convenient and obvious means for distinguishing species. It is often used as a supplementary character to separate sections or series. For example, over ninety-five per cent of the species in the section *Pseudoaquifolium* have entire leaves. The *Lauroilex* species all have entire leaves and the *Prinoides* species all have chartaceous or membranaceous, serrate or crenate leaves.



6. VENATION: All the Chinese *Ilex* have pinnate, netted veins. The midribs are usually impressed above and elevated beneath. Midribs elevated above are often used as supplementary characters for distinguishing species. The lateral nerves of *Ilex* vary from two, three, or four pairs in *Ilex intricata* Hook. f. to ten to twenty pairs in *Ilex polyneura* (Hand.-Mzt.) S. Y. Hu. An appreciable difference in the number of the lateral nerves is always a convenient quantitative means for separating closely related species, for example, *Ilex micrococca* Maxim. is distinguished from *Ilex polyneura* by having only six to eight pairs of lateral nerves. About forty-seven per cent of the Chinese species of *Ilex* have obscure lateral nerves and veinlets, at least on the upper surfaces. In the case of herbarium specimens, venation is often affected by the method of preparation of the plants. In Prinoides all species have distinct veinlets, while most of the species in Lioprinos have obscure veinlets. In the Hookerianae all the species have veinlets impressed on the upper surface. *Ilex tsoii* Merr. & Chun of the section Prinoides can be readily distinguished even in a sterile condition because of the very distinct veinlets.

7. PETIOLES: Most species of the *Ilex* have canaliculate petioles. Few of them have plane ones. The presence or absence of grooves on the upper surface of the petioles is often useful in separating species. For example, specimens of *Ilex sterrophylla* Merr. & Chun from Hainan have been identified as representing *Ilex pedunculosa* Miq. But without reference to the indumentum or pyrene characters, the former can readily be distinguished from the latter by its plane petioles.

The length of the petiole varies from 2–4 mm. in *Ilex cinerea* Champ. to 15–25 mm. in *Ilex sterrophylla* Merr. & Chun. The differences in the ratio between the leaves and the petioles are more striking. In *Ilex cinerea* the petioles are one thirty-sixth to one-nineteenth the length of the lamina, and in *Ilex sterrophylla* one-fourth to one-half. This proportional difference is another quantitative measure often used in separating species.

8. STIPULES: Van Steenis in 1948 (in Bull. Bot. Gard. Buitenz. III. 17: 389) called attention to the fact "that in British botany there is much controversy as to the occurrence of stipules in Aquifoliaceae." He cited authors like Hooker, f., Brandis, and Christie. Even as late as 1926, Hutchinson says, "Stipules absent."

The Chinese representatives of the Aquifoliaceae are essentially stipulate, and in ninety per cent of the species, the stipules are present and persistent even after the leaves fall. In the other ten per cent the stipules are obscure or lacking by abortion. In general the stipules are minute, callose, deltoid, less than one millimeter long. The largest stipules of the Chinese *Ilex* are found in *Ilex serrata* Thunb. var. *sieboldi* (Miq.) Rehd. In this species they are 2 mm. long, pilose, and caducous.

The presence or absence of stipules is of serial significance. It is of great interest to know that all the species that are devoid of stipules are in the series Chinenses. Thus the presence or absence of stipules can be used as a supplementary character for differentiating this series from its closely related ones.

The size of the stipules of closely related species is rather definite. Examples can be found in *Ilex polyneura* (Hand.-Mzt.) S. Y. Hu and *Ilex micrococca* Maxim. In the former species the stipules are 1–1.5 mm. long, and in the latter only 0.2–0.3 mm. In such a case the stipules can be used as a good supplementary character in distinguishing species.

IV. Inflorescences: The fundamental organization of the inflorescences in the genus *Ilex* is a trichotomous axillary cyme as illustrated by *Ilex chinensis* Sims and *Ilex ferruginea* Hand.-Mzt. Through reduction or multiplication of such cymes, and as a result of the evolution of the shoot system, directed towards a division of labor, various types (as illustrated in figures 3 and 4) of inflorescences may be evolved. The types of the inflorescences and their position on the branchlets are of important consideration in this work.



FIG. 1. TYPES OF THE SOLITARY INFLORESCENCE IN *Ilex*: a & b. simple cymes; c. dichotomous compound cyme; d. trichotomous compound cyme; e. long-pedicellate solitary flower; f. short-pedicellate solitary flower; g. pseudo-umbel; h. head-like inflorescence.

1. **TYPES OF THE INFLORESCENCE:** The Chinese *Ilex* exhibit a very interesting set of inflorescences. According to their positions on the branchlets I discuss them under the following two heads.

a. *Solitary type:* The solitary type of inflorescence occurs only on the current year's growth. They are nearly all axillary to a leaf and are often associated with an adaxial dormant vegetative bud. The simplest kind of such solitary inflorescences consists of a cyme with three flowers. Its peduncle is about 5–10 mm. long, and the pedicels of the individual flowers are usually shorter than the peduncle. Examples are the pistillate inflorescences of *Ilex ferruginea* Hand.-Mzt. (fig. 1, b) and the staminate flower of *Ilex macrocarpa* Oliv. (fig. 1, a).

From the simple cyme evolution can proceed by the multiplication of branches. This is shown in the dichotomous compound cyme with evident secondary axes, like those of the pistillate flowers of *Ilex maclurei* Merr. (fig. 1, c), or a trichotomous compound cyme with rather long secondary axes and evident tertiary axes, like those found in *Ilex micrococca* Maxim. (fig. 1, d).

By reduction in the number of flowers in the simple cyme there may be evolved a solitary flower with a long pedicel and two median or supermedian prophylla (scales on the pedicel), as, for example, the pistillate flower of *Ilex yunnanensis* Franch. (fig. 1, e). Reduction of both the number of flowers and the length of the pedicel of a simple cyme may occur. Then there is evolved a sessile solitary fruit borne on a pedicel 2–3 mm. long, at the middle of which are the scars of two abortive flowers. The pistillate flowers of *Ilex lancilimba* Merr. (fig. 1, f) are an example.

By the reduction of the secondary axes of a compound dichotomous cyme there can be evolved a pseudo-umbel that has a peduncle 10–20 mm. long, and many bracteoles at the bases of the pedicels. Examples occur in the staminate or the pistillate inflorescences of *Ilex umbellulata* (Wall.) Loes. (fig. 1, g). If such reduction also occurs in the pedicels, then a subcapitate inflorescence like that of *Ilex tugitakayamensis* Sasaki (fig. 1, h) may be evolved.

b. *Fasciculate types:* The fasciculate types of inflorescence occur only on the second year's growth or on older growth. They are axillary to old leaves and never have a dormant axillary bud at their base. The commonest kind consists of a sessile fascicle with a basal collar formed of several persistent cartilaginous or leathery bud-scales, and a short axis with or without an abortive terminal bud. A membranaceous scale subtends each of the 1–3-flowered individual branches. The staminate inflorescences of *Ilex ficoidea* Hemsl. (fig. 2, a) are examples of this type.

Through multiplication by the branching of the individual branches, a fascicle with trichotomous compound cymes or with pseudo-umbels, as in the *Lauroilex* (fig. 2, b & c), may be evolved. By an increase in the number of flowers on the branches and the elongation of the central axis, a pseudopaniculate inflorescence such as the staminate inflorescence of *Ilex latifolia* Thunb. (fig. 2, d) may result. By a reduction in the number of

flowers on the branches, a loose fascicle or pseudoraceme of uniflorous cymes may develop. The pedicels each bear one or two submedian prophylla. This is the condition in the flowers of *Ilex intermedia* Loes. (fig. 2, e). By the shortening of both the axis and the pedicels, a compact fascicle of uniflorous pedicels, each bearing one or two basal prophylla, may develop, as in the pistillate inflorescences of *Ilex corallina* Franch. (fig. 2, f). Reduction in the number of individual flowers in the fascicle produces paired fruits as in *Ilex hanceana* Maxim. and *Ilex perryana* S. Y. Hu (fig. 2, g). A further reduction of the number of the flowers gives the solitary-flowered condition, as found in *Ilex chingiana* Hu & Tang



FIG. 2. TYPES OF THE FASCICULATE INFLORESCENCE IN *ILEX*: a. fascicle with 1-3-flowered individual branches; b. fasciculate compound cymes; c. fasciculate pseudo-umbels; d. pseudopanicule; e. loose fascicle with uniflorous individual branches; f. compact fascicle with uniflorous individual branches; g. paired fruits; h. solitary fruit of a much reduced fascicle.



(fig. 2, h). In this the scar or scars at the base of the fruiting pedicel indicate the positions of the aborted flowers.

## 2. STRUCTURE OF THE INFLORESCENCES:

a. *Bud-scales*: The fasciculate type of inflorescence is evolved from an axillary bud. The bud-scales of these inflorescences are often persistent. They are cartilaginous or coriaceous. Sometimes it is hard to differentiate bud-scales from the bracts, for the change in texture is gradual.

b. *Bracts*: The scales that subtend the individual branches of a fascicle are called bracts in this paper. Those that subtend the secondary or tertiary branches are called bracteoles. Most bracts have stipule-like basal appendages. The size and shape of these appendages are sometimes of serial importance; for example, all the Repandae have bracts with long, slender, ciliate appendages.

c. *Prophylla*: The scales on the pedicels, which do not subtend flowers are called prophylla. Their insertion may be basal, superbasal, median, or supermedian on the pedicels. The insertion of the prophylla is often used as an auxiliary character for distinguishing species; for example, besides the size of the fruit and the texture of the leaves, *Ilex tephrophylla* (Loes.) S. Y. Hu is differentiated from *Ilex corallina* Franch. by its minute prophylla, which cover less than half of the fruiting pedicel, while, in contrast, the prophylla of *Ilex corallina* reach the calyx.

d. *Peduncles*: The stalks of all the branched solitary types of inflorescence and those of the multiflorous individual branches of the fasciculate types are called peduncles in this work. The peduncles of the solitary inflorescences possess no bracts at their bases. Those of the fasciculate inflorescences all have basal bracts. The length of the peduncle of a species is a variable character. In a few cases it has been used as an auxiliary means for distinguishing species. For example, *Ilex rotunda* Thunb. is differentiated from *Ilex umbellulata* (Wall.) Loes. by its shorter peduncles (9–13 mm. long), and *Ilex sterrophylla* Merr. & Chun is differentiated from its closely related species, *Ilex editicostata* Hu & Tang, by its peduncles of a length of 2–3 cm.

e. *Pedicels*: The stalks of either the solitary individual flowers or of the ultimate branches of compound inflorescences are called pedicels in this paper. The longest pedicels, those of *Ilex pedunculosa* Miq., are 4–4.5 cm. long. But this length is extremely rare. In general the pedicels of *Ilex* are 2–15 mm. long. Most of them possess one or two prophylla at the base (basal), at the middle (median), or above the middle (supermedian).

The length of the pedicels of *Ilex* is a rather stable character. It is an obvious quantitative character for distinguishing species. Thus *Ilex asprella* (Hook. & Arn.) Champ. is differentiated from all the other *Prinos* species by its long slender pedicels. Even between closely related species like *Ilex macropoda* Miq. and *Ilex tsoii* Merr. & Chun the length of the fruiting pedicels is a dependable character for separating them.

f. *Central Axis*: All the fasciculate types of inflorescence have central

axes. These may be very short, even almost completely suppressed, as in *Ilex corallina* Franch. or *Ilex intricata* Hook. f. Or they may be quite long, so long, in fact, that the inflorescences appear pseudoracemose, as in *Ilex intermedia* Loes., or pseudopaniculate, as in *Ilex latifolia* Thunb. The length of the central axes of different inflorescences on a single branchlet may vary considerably, and thus it is not a good character to use for distinguishing species. As an auxiliary character it is sometimes useful in separating a variety from a species; for example, *Ilex confertiflora* Merr. var. *kwangsiensis* S. Y. Hu is differentiated from the typical species by its large leaves and its central axis of a length of 22 mm.

g. *Secondary and Tertiary Axes:* The compound cymes, both solitary and fasciculate, all possess secondary or sometimes tertiary axes. The presence or absence of the secondary axis and its relative length are convenient distinguishing characters. For example, *Ilex machurei* Merr. is distinguished from the rest of the Chinese *Ilex* species by having a secondary axis in the infructescence. Besides having more numerous lateral nerves, *Ilex polyneura* (Hand.-Mzt.) S. Y. Hu is also distinguished from its very close relative, *Ilex micrococca* Maxim., by the fact that its secondary axis is shorter than the fruiting pedicel.

3. *SEXUAL DIMORPHISM:* All the Chinese species of *Ilex* are dioecious. The inflorescences of almost all the species are sexually differentiated. In over ninety per cent of the species the staminate inflorescences are more prolific, and the flowers are more showy. This abundant flowering is attained by the branching of the solitary inflorescence or the fascicle, or through the specialization of the shoot systems (one species), or through both.

Nearly all of the more prolific staminate inflorescences result from increased branching. In *Ilex serrata* Thunb. var. *sieboldi* (Miq.) Loes. the inflorescence is solitary. The pistillate flowers are usually solitary or rarely a much reduced 2- or 3-flowered cyme with a peduncle 1-1.5 mm. long. The staminate ones are cymose, with nine to twenty-one flowers and peduncles 3 mm. long. In *Ilex chinensis* Sims the pistillate cymes are usually 3- to 7-flowered, with the peduncles usually shorter than the leaf-petioles, and the staminate cymes usually have twenty-one or more flowers, with the peduncles always exceeding the leaf-petioles in length. In all the species of the section *Aquifolium* the pistillate fascicles have one-flowered individual branches, while those of the staminate fascicles are 3- to 5-flowered. Many of these staminate fascicles, such as those of *Ilex latifolia* Thunb., are so prolific that they appear pseudopaniculate.

About nine per cent of the more prolific staminate inflorescences are due to both branching and specialization of the shoot system. In *Ilex microcarpa* Oliv., for example, the pistillate flowers are solitary axillary, and the staminate flowers are one- or three-flowered, cymose, and often fasciculate. Such a condition is also common in *Ilex yunnanensis* Franch., *Ilex crenata* Thunb., and their related species.

*Ilex asprella* (Hook. & Arn.) Champ. is the only species that has solitary

pistillate flowers and fasciculate staminate flowers with the individual branches uniflorous.

The inflorescences of the Chinese species of *Ilex* are as a whole inconspicuous. The great reduction of the number of flowers in the pistillate inflorescences makes them less conspicuous than the staminate ones, and hence the female plants are less attractive to collectors, especially inexperienced ones. Many of the Chinese *Ilex* are unrepresented in the herbarium by flowering specimens and specimens with pistillate flowers are especially uncommon.

Because of this sexual dimorphism in the inflorescences, an unduly large number of new species have been proposed by workers who either lacked sufficient material or who did not appreciate the significance of sexual dimorphism. This has added greatly to the synonymy of certain species.

**V. Flowers:** The flowers of *Ilex* are all small and inconspicuous. When fully opened, the majority of them are 5–6 mm. in diameter. The largest, the staminate flowers of *Ilex latifolia* Thunb., are only 9 mm. in diameter. The flowers of *Ilex micrococca* Maxim. measure only 3–4 mm. in diameter.

The color of the flowers of *Ilex* is never brilliant. In the total number of species of which we have floral records, about eighty-four per cent are greenish yellow or white and about thirteen per cent are pink, lavender, or red. The flowers of *Ilex intricata* Hook. f. are chocolate-colored. In *Ilex lancilimba* Merr. the pistillate flowers are pink-purple and the staminate flowers greenish white. The color of the flowers of *Ilex yunnanensis* Franch. has been reported as greenish yellow, cream-white, or red. It is most likely that the color of the flowers of this species varies with the age of the flowers and also with the habitats of the plants. The color of the flowers of *Ilex* appears to have some correlation with other characters of the various groups. All the members of the subgenus *Prinos* have white flowers. A majority of the pink, lavender, or red-flowered species are in the section *Lioprinus*. All the *Aquifolium* with the exception of *Ilex intricata* Hook. f. have greenish yellow or cream-white flowers. But due to the small size and the lack of attractive color of the flowers, they have been overlooked in the field, and thus flowering specimens are often poorly represented in herbaria. For this reason, in this paper the color of the flowers has not been taken into consideration in distinguishing species.

Of the total species of which we have floral records, thirteen per cent have been reported as fragrant. Personally I have observed bees and small wasps visiting the white and fragrant flowers of *Ilex macrocarpa* Oliv. in the woods of West China.

There are no field records concerning the length of the flowering period of a species. Experience tells us that for a period of two weeks one can collect good flowering specimens from a tree of *Ilex macrocarpa* Oliv. growing to a height of ten meters.

The height of the flowering season, as one would expect, is in April,

with approximately one-third of the species producing flowers at this time. May and June come next, with March and July following in that order. A very few species may be found flowering in January and December.

The floral characters which are valuable in the classification of the species are summarized here.

1. CALYX: In *Ilex* the calyx is always persistent. At anthesis it is usually patelliform, but after the fruiting stage it becomes explanate. It is small, measuring 2–4 mm. in diameter. The dimension of the persistent calyx is of serial significance. In all members of the series *Sideroxyloides* the calyx is large for the genus, its diameter measuring over half that of the fruits. All representatives of the *Repandae* have a small quadrangular calyx 2 mm. in diameter.

The indumentum of the calyx-lobes is a rather variable character. In the species *Ilex triflora* Blume, for instance, the calyx may be either sparsely or densely pubescent. Hence this characteristic has been little featured in the classification of the species. On the other hand, the presence or absence of cilia on the margin of the calyx-lobes is quite constant. It has occasionally been employed as a supplementary character in distinguishing species or varieties.

2. COROLLA: The shape and size of the corolla of the staminate flowers of all the species are fairly constant. The corolla is always rotate, with the petals slightly united at the base. The free parts of the petals are oblong, 2–3, rarely up to 4 mm. long. The apical half of the petals of the *Repandae* is ciliate.

In the pistillate flowers, the corolla is rotate, with the base of the petals considerably more united in the *Paltoria* or only slightly so in the *Lioprinus* and the *Venulosae*, or suberect, with the base of the petals either slightly united or choripetalous in *Aquifolium* and in *Pseudoaquifolium*. The differences in the shape of the corolla and the degree of union of the petals seem to have serial or sectional significance. But the inadequate representation of the pistillate flowers in the herbaria has restricted the use of these characters in classification.

3. STAMENS AND STAMINODES: At full anthesis the stamens of *Ilex* may be longer than the petals, as in the *Repandae*, equaling the petals, as in *Ilex wenchowensis* S. Y. Hu, or shorter than the petals, as in *Ilex crenata* Thunb. The anthers are usually oblong-ovoid, 0.75–1 mm. long. As the length of the filament and the shape of the anthers change with the age of the flower, these characters have not been used in distinguishing species.

The abortive stamens of the pistillate flowers are called staminodes in this paper. They are always shorter than the petals. Their anthers are either sagittate, cordate, or ovate. They are glabrous except in *Ilex memecylifolia* Champ. The hairy staminodes of this species have been used as a supplementary character for distinguishing it from its close relatives.

4. OVARY AND RUDIMENTARY OVARY: The ovary of the flower of all



the species of *Ilex* is syncarpous, with two up to thirteen carpels. At anthesis it is usually ovoid, 1–2 mm. in diameter, devoid of style, but with a discoid and lobed stigma, as in *Ilex serrata* Thunb. var. *sieboldi* (Miq.) Loes. (fig. 3, a), or with a slightly elevated and pointed mammiform stigma, as in *Ilex kwangtungensis* Merr. (fig. 3, b). In *Ilex tsoii* Merr. & Chun the ovary is subglobose with a capitate stigma (fig. 3, c). In *Ilex fragilis* Hook. f. the ovary is pulvinate, with an evident style and a capitate or narrow-cristate stigma (fig. 3, d). In *Ilex macrocarpa* Oliv. the ovary is ovoid, with an evident style and a columnar stigma (fig. 3, e).

The shape of the stigma (especially after the fruit attains maturity) and the presence of a style are very constant characters in some species of *Ilex*. Therefore they are of fundamental importance in the delineation of species and even of sections. The columnar stigma is characteristic of *Ilex macrocarpa* Oliv., *Ilex chapaensis* Merr., and many members of the series *Sideroxyloides*. A majority of the species of the series *Denticulatae* have plane or slightly impressed navel-like stigmas.

In general the ovary is glabrous. In *Ilex pubilimba* Merr. and *Ilex wangiana* S. Y. Hu the ovary and the fruit are sparsely pubescent. These characters set the two species off from their close relatives.

The abortive ovary of the staminate flowers is called the rudimentary ovary in this work. It may be subglobose with obtuse or slightly impressed center, or pulvinate with a rostellate and cleft apex as in *Ilex micrococca* Maxim. (fig. 3, g). The presence or absence of the rostellum on the rudimentary ovary is of serial or sectional significance. For example, all the *Micrococca* and the *Umbelliformes* species have rostellate rudimentary ovaries. A branchlet of *Ilex chapaensis* Merr. with staminate flower can be distinguished from one of *Ilex macrocarpa* Oliv. only by the rostellum on the ovary. The rudimentary ovary is always glabrous except in *Ilex brachyphylla* (Hand.-Mzt.) S. Y. Hu (fig. 3, f).

VI. **Fruit:** Over ninety-five per cent of the Chinese *Ilex* species possess red fruit. This fruit reaches maturity in autumn and persists on the tree for a long time, often until the plant flowers again the following spring. Trees or shrubs with scarlet fruit, whether accompanied by leaves or not, are striking sights in any landscape. They attract the collectors' attention. Even the black-fruited *Ilex* is not altogether devoid of means for attracting attention. Some species, like *Ilex asprella* (Hook. & Arn.) Champ. have their fruit projected from the branchlets on extremely long pedicels (fig. 3, i), and others, like *Ilex macrocarpa* Oliv., have extraordinarily large fruit (fig. 3, h). Since the fruit of over ninety-eight per cent of our species of *Ilex* is known, it is of fundamental importance in the classification of the genus. Thus any character that one can draw from the fruit, be it the size, the color, the pedicel, the persistent calyx, the style (when present), or the stigma, is of some aid in distinguishing the species.

1. **SIZE:** Nearly all of the fruit of the Chinese *Ilex* is less than 8 mm. in diameter (usually 4–7 mm.). The larger fruits are usually limited to

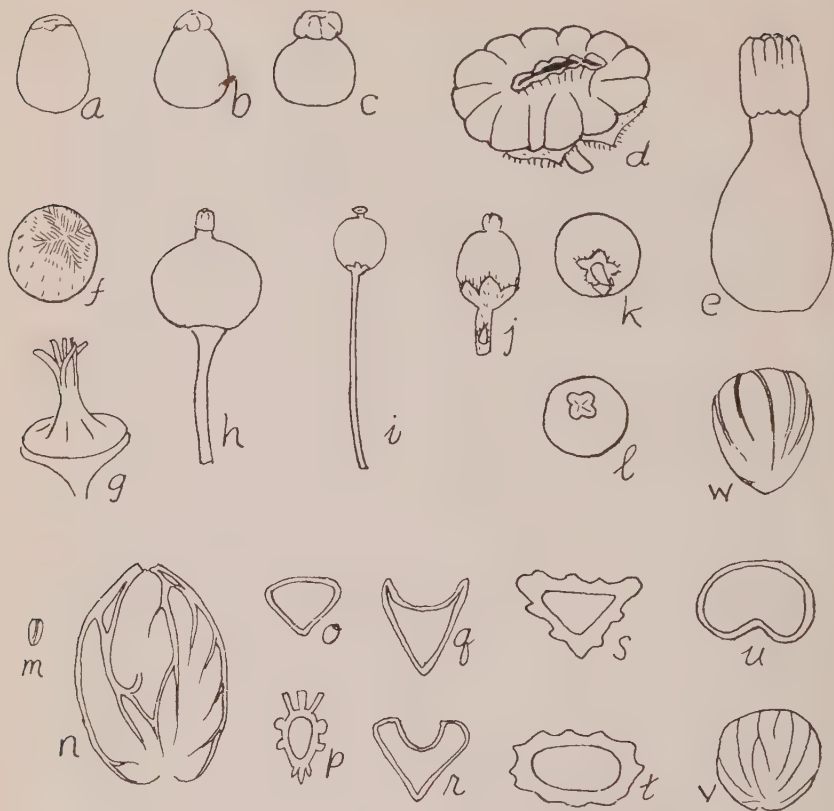


FIG. 3. *a-e*. STIGMA: *a*. discoid stigma of ovary of *I. serrata*; *b*. mamiform stigma of *I. kwangtungensis*; *c*. capitate stigma of *I. tsoii*; *d*. cristate stigma of *I. fragilis*; *e*. columnar stigma of *I. macrocarpa*. *f* & *g*. RUDIMENTARY OVARY: *f*. globose and pubescent rudimentary ovary of *I. brachyphylla*,  $\times 12$ ; *g*. rostellate rudimentary ovary of *Ilex micrococca*,  $\times 10$ . *h-l*. FRUIT: *h*. a large fruit of *I. macrocarpa* with columnar stigma,  $\times 1$ ; *i*. a long-pedicellate fruit of *I. asprella* with capitate stigma,  $\times 1$ ; *j*. large persistent calyx of fruit of *I. metabaptista*,  $\times 2$ ; *k*. small calyx of fruit of *I. ficoidea* showing the pedicel and prophylla,  $\times 2$ ; *l*. the same showing the discoid stigma. *m* & *n*. SIZE OF PYRENES: *m*. a small smooth pyrene of *I. wardii*,  $\times 2$ ; *n*. a large rugose pyrene of *I. chingiana*,  $\times 2$ . *o-u*. OUTLINE OF THE CROSS-SECTIONS OF PYRENES, all  $\times 3$ : *o*. triangular, smooth with thin endocarp, *I. pedunculosa*; *p*. 3-ridged and 2-canaliculate pyrene, *I. macrocarpa*; *q* & *r*. U-SHAPED PYRENES WITH SMOOTH THIN ENDOCARP; *s*. triangular thick-walled stony pyrene of *I. subficoidea*; *t*. elliptic thick-walled woody pyrene of *I. diphyrena*; *u*. suborbicular smooth pyrene of *I. perryana*. *v* & *w*. PALMATELY STRIATE PYRENES: *v*. striate, esculate pyrene of *I. perryana* with slightly impressed striae; *w*. striate and sulcate pyrene of *I. ficoidea*.

the section Prinoides and to the series Aquifolioides and Denticulatae of the section Aquifolium.

2. FRUITING PEDICEL: The length of the fruiting pedicels varies from 1–2 mm. long in *Ilex ficoidea* Hemsl., *Ilex corallina* Franch., and many others in the series Dipyrenae or Repandae to 40–45 mm. long in *Ilex pedunculosa* Miq. This difference in the length of the fruiting pedicels has been used as a supplementary character in distinguishing species and varieties.

3. PERSISTENT CALYX: The size of the persistent calyx of the fruit of *Ilex* is constant in the series and sometimes in the sections. The series Sideroxyloides is characterized by the large persistent calyx, which is over half the diameter of the fruit (fig. 3, j). On the other hand, the series Aquifolioides and the Repandae are characterized by their quadrangular persistent calyxes (fig. 3, k).

4. STIGMA: The stigma of the mature fruit is quite a constant character, useful as a supplementary character for distinguishing species. Some of the stigmas, like those of the Denticulatae, are plane or somewhat navel-like, some, as those of *Ilex ficoidea* Hemsl., discoid (fig. 3, l), some, like those of *Ilex pubescens* Hook. & Arn., capitate, and some are cristate, as in *Ilex fragilis* Hook. f. (fig. 3, d).

All members of the genus have fleshy fruit, with chartaceous exocarp, fleshy and juicy mesocarp, and distinct coriaceous woody or stony endocarps, each enclosing a seed. In classification there seems to be no proper term to apply to this type of fruit. DeCandolle (Prodr. 2: 13. 1825) called it a berry, "bacca." Hooker (Gen. Pl. 1: 357. 1862) referred to it as a drupe, "drupa," as did Loesener. But the fruit of *Ilex* is neither a berry nor a drupe, for a berry does not possess a hard endocarp, and a drupe has only a single stone, since it is derived from a single carpellate ovary. The hard parts in a berry are the seeds. The hard portion of the fruit of *Ilex* is the endocarp with the vascular bundles clinging to it or loosely attached to it. The fruit of the genus might be termed a drupe-like berry or a berry-like drupe. To make things simple and definite, however, I would like to propose the term bacco-drupe and define it as a fruit derived from a syncarpous ovary with chartaceous exocarp, fleshy mesocarp, and separated coriaceous, woody or stony endocarps (pyrenes), each enclosing a single seed. It is characteristic of all *Ilex* species except *Ilex insignis* Hook. f. of India.

VII. Pyrenes: The seed of *Ilex*, enclosed by the endocarp, is called a pyrene in this work. The pyrenes of all the Chinese *Ilex* are in one whorl embedded in the soft mesocarp. Their abaxial surface is much broader than the keel-like adaxial surface. The abaxial surface of a pyrene is called the dorsal surface in this paper.

Like the fruit, the pyrenes are commonly available in the herbaria and are important in the classification of the genus.

1. NUMBER: About seventy per cent of the Chinese *Ilex* species have four pyrenes. The remaining species possess a varying number, from one

to thirteen. The number in those species producing four pyrenes is constant. The number in those species which have more or less than four pyrenes is generally variable; for example, a branchlet of *Ilex fragilis* Hook. f. var. *kingii* Loes. has many fruits with six to eight pyrenes and some with nine to thirteen. A single branchlet of *Ilex dipyrena* Wall. bears many fruits with two pyrenes and some with one, three, or four. The large percentage of the four-pyrene species and the variability in the number of the more or less than four-pyrened species both indicate that four-merous may have been the fundamental condition of the flower parts, including the ovary, of *Ilex*, and that the other numbers are derivatives.

The pyrene number has no subgeneric significance. Both the subgenera *Prinos* and *Euilex* have four-pyrened species. Species with five or more pyrenes are common to both subgenera. Nevertheless, the species that have less than four pyrenes are all confined to the series *Dipyrenes* of the *Euilex*.

The number of the pyrenes has provided a valuable supplementary character for separating the sections; for example, all of the species of the *Aquifolium* have four pyrenes with woody or stony endocarps, and those of the *Pseudoaquifolium*, on the other hand, have more than four pyrenes, with coriaceous or sublignescent endocarps.

2. SIZE AND SHAPE: The smallest pyrenes are found in *Ilex wardii* Merr. and are ca. 1.5 mm. long (fig. 3, m). The largest are found in *Ilex chingiana* Hu & Tang and measure approximately 15 mm. long (fig. 3, n). The pyrenes in other species of the genus fall between these extremes.

With a few exceptions, the cross-section of a pyrene of *Ilex* is triangular in outline. In *Ilex pedunculosa* Miq. (fig. 3, o) the dorsal surface is smooth and convex. In *Ilex macrocarpa* Oliv. (fig. 3, p) the dorsal surface is 3-ridged and 2-canaliculate. In *Ilex lancilimba* Merr. (fig. 3, q) the dorsal surface is widely U-shaped. In *Ilex kwangtungensis* Merr. (fig. 3, r) the dorsal surface is narrowly U-shaped. In *Ilex subficoidea* S. Y. Hu (fig. 3, s) the dorsal surface is rugose and uneven. Other variations in the outline of the cross-section of the pyrene are found in *Ilex dipyrena* Wall. (fig. 3, t) where it is oblong-elliptic, and in *Ilex perryana* S. Y. Hu (fig. 3, u) where it appears suborbicular.

Viewed from the dorsal surface, the pyrenes show varied shapes, namely oblong, oblong-elliptic, elliptic, or rarely suborbicular or obovate. The ends may be pointed or obtuse, rarely retuse.

The shape of the pyrenes is sometimes of significance in the delimiting of the series. The *Umbelliformes* have narrow elliptic pyrenes with pointed ends, while the *Repandae* have oblong pyrenes, usually with obtuse ends.

3. TEXTURE AND SCULPTURE: The texture of the pyrene of *Ilex* varies from coriaceous as found in *Ilex crenata* Thunb. through sublignescent as found in *Ilex rotunda* Thunb., to woody as found in *Ilex pernyi* Franch., and finally to stony as found in *Ilex latifolia* Thunb.

The sculpture of the pyrenes of *Ilex* exhibits a very interesting set of variations. This character is very valuable in distinguishing species. The



descriptive terms used in this work concerning the surface of the pyrene need some definition: (1) estriate and esulcate pyrenes are those that are smooth, coriaceous, free from any vascular bundles of the pericarp, as in *Ilex yunnanensis* Franch.; (2) striate and esulcate pyrenes are those that are smooth, coriaceous, but with vascular bundles loosely attached to the surface, as in *Ilex longicaudata* Comber; (3), striate, esulcate pyrenes with impressed striae are those that are smooth, coriaceous, but with the vascular bundles slightly sunk into the endocarp, as in *Ilex crenata* Thunb.; (4) striate esulcate pyrenes with elevated striae are those that are coriaceous and with the vascular bundles clinging to the surface of the pyrenes, as in *Ilex metabaptista* Loes.; (5) striate and sulcate pyrenes are those that are sublignescens and with three elevated vascular bundles evenly and longitudinally fused with the dorsal surface of the endocarp, as in *Ilex rotunda* Thunb.; (6) palmately striate and sulcate pyrenes are those that are woody, with the vascular bundles on the surface of the palmate ridges of the endocarp, as found in *Ilex ficoidea* Hemsl. (fig. 3, w); (7) rugose, pitted, or wrinkled pyrenes are those that are stony, with irregularly branched and anastomosing vascular bundles which extend over the protuberances, as in *Ilex subficoidea* S. Y. Hu and *Ilex chingiana* Hu & Tang (fig. 3, n); (8) unicanalicate pyrenes are those that are sublignescens or coriaceous and have a U-shaped cross-section (fig. 3, q & r), as in *Ilex lancilimba* Merr. or *Ilex chinensis* Sims; and (9) the three-ridged and two-canaliculate pyrenes are those that are stony, with the endocarp so modified that the dorsal surface has two deep canals (fig. 3, p), as in *Ilex macrocarpa* Oliv.

These various types of pyrenes are of sectional or serial significance. In the subgenus *Prinos*, the *Pseudoprinos* have smooth striate and esulcate pyrenes with impressed striae. The *Micrococca* have unicanalicate pyrenes, the *Prinoides* have striate and sulcate or three-ridged and two-canaliculate pyrenes. In the subgenus *Euilex*, the *Chinenses* have unicanalicate pyrenes, the *Umbelliformes* have three-striate and two-sulcate pyrenes; the *Paltoria* have smooth, striate esulcate, or estriate and esulcate pyrenes, and the *Aquifolium* have palmately striate and sulcate or rugose and pitted pyrenes.

## GEOGRAPHIC DISTRIBUTION

The geographic distribution of the Chinese Aquifoliaceae reaches its northern limit in the provinces of the Yangtze River basin; thence it extends southward into Indo-China and India. Except for a form of *Ilex crenata* Thunb., a native of Japan, introduced and cultivated in a park of Tsing-tao, Shantung, and a few specimens of *Ilex pernyi* Franch., from Tsing-ling, a mountain range on the border of Szechuan, Kansu, and Shensi, no *Ilex* has ever been recorded from either North or Northwest China. Latitude 33° N. seems to be the northern limit for a natural distribution of the Chinese Aquifoliaceae. From this latitude southward the number of species occurring in each province is as follows: southern

Kiangsu, 3; southern Honan, 1; southern border of Shensi and Kansu, 1 each; Chekiang, 23; Anhwei, 12; Kiangsi, 17; Hupei, 17; Hunan, 12; Kweichow, 24; Szechuan, 18; Sikang, 9; Yunnan, 38; Kwangsi, 38; Kwangtung, 26; Fukien, 13; Taiwan, 18; Hainan, 21; and Hongkong, 10. Though some of the species are widely distributed, covering from six to twelve provinces, and a few of them extend even to Japan and Korea in the north, to Himalaya or North India in the west, and one of them to Java in the south, the majority of them, especially those species in the sections of *Aquifolium*, *Lauroilex*, and *Pseudoaquifolium*, are localized to less than five provinces. Some of them, like *Ilex cinerea* Champ. are endemic even to a small coastal island like Hongkong.

Judging by the large number of species and the many intermediate forms found there, it seems that South China and Southwest China, or, to be more specific, the border region of Kwangtung, Kwangsi, Yunnan, and Indo-China, is the center of the distribution of the Asiatic *Ilex*. From there various species disperse radiately to form the Sino-Japanese, the Sino-Himalayan, and the Sino-Indo-Malaysian elements of the genus. This assumption is supported by much evidence. In the series *Umbelliformes*, *Ilex rotunda* Thunb. is the most northern of the Sino-Japanese elements; those occur in East China and Japan. It is an entire-leaved glabrous species with striate sulcate narrow-elliptic pyrenes. *Ilex excelsa* (Wall.) Hook. f. is the most southern of the Sino-Himalayan elements; those occur in Southwest China and North India. It is also an entire-leaved species, but with puberulous inflorescences and striate-esulcate smaller but broader pyrenes. *Ilex rotunda* var. *microcarpa* (Lindl. & Paxt.) Hu is an intermediate form that occurs in South China and northern Indo-China, and is characterized by its puberulous inflorescences, small broad-elliptic striate and slightly sulcate pyrenes. Among these three the changes in the indumentum, the size and shape of the pyrenes, and the sculpture of the endocarp are so gradual that it is sometimes difficult to tell to which species a specimen collected from the geographically intermediate provinces like Kwangsi belongs. Similar behavior occurs in the series *Stigmatophorae*, involving the Sino-Japanese element *Ilex crenata* Thunb., the Sino-Indo-Malaysian element *Ilex triflora* Blume, and the intermediate species *Ilex viridis* Champ. of South China; in the series *Cassinoides*, involving the Sino-Himalayan element *Ilex yunnanensis* Franch. and the Sino-Japanese element *Ilex sugeroki* Maxim.; and in the section *Aquifolium*, involving the Sino-Japanese element *Ilex latifolia* Thunb., the Sino-Himalayan element *Ilex denticulata* Wall. ex Wight., and the Chinese species *Ilex intermedia* Loes.

The altitudinal range of the Chinese *Ilex* extends from sea-level in the coastal provinces to a height of 3400 m. in the mountains of Yunnan. In general, as the habitat changes from low to high altitudes, the habit of the plants changes from trees to shrubs. In the subalpine Yunnan flora, three prostrate or creeping species of *Ilex* have been reported. Such creeping forms have otherwise been recorded only from Yezo of northern Japan and Sakhalin and the Himalaya.

The Chinese *Ilex* seems to illustrate a very interesting tie between the flora of Hainan and that of Indo-China, which, from a geographic and hydrographic standpoint, is to be expected. Examples of this are found in *Ilex pubilimba* Merr., *Ilex cochinchinensis* (Lour.) Loes., *Ilex kobuskiana* S. Y. Hu, and *Ilex hainanensis* Merr. & Chun. The flora of Taiwan (Formosa) also has close relationship with that on the mainland, especially that of Chekiang, Fukien, and, for certain high-altitude species, also Yunnan. Numerous examples in *Ilex* representative of this can be cited, notably *Ilex pubescens* Hook. & Arn., *Ilex formosana* Maxim., *Ilex yunnanensis* Franch., and *Ilex boiritsensis* Hayata.

Another interesting fact is that the Chinese Aquifoliaceae indicate a certain affinity between the floras of eastern Asia and eastern North America. The fruiting branches of *Ilex tsoii* Merr. & Chun from East, Central, and South China, resemble so closely those of *Ilex montana* Torr. & Gray of eastern North America that only a specialist could distinguish them. The same is true of *Ilex aculeolata* Nakai of China and *Ilex decidua* Walt. of eastern North America; *Ilex asprella* (Hook. & Arn.) Champ. of South China, Taiwan, and Luzon, and *Ilex longipes* Chapm. of eastern North America; *Ilex yunnanensis* Franch. of China and *Ilex glabra* (Linn.) Gray; and *Ilex serrata* Thunb. var. *sieboldi* (Miq.) Rehd. of China and Japan and *Ilex verticillata* (Linn.) Gray of eastern North America. In general, however, there is a vast difference between the Chinese and the American *Ilex*. In China more than ninety per cent of the species are evergreen, with comparatively few deciduous species, while in eastern North America most of the species are deciduous.

The great concentration of *Ilex* in China is shown by statistics giving the number of species found in Malaysia, as well as in adjoining countries of Asia. Pitard in 1912 (Lecomte, Fl. Gén. Indo-Chine 1: 850-862) admitted seventeen species for Indo-China, but by 1948 Tardieu-Blot (Lecomte, Fl. Gén. Indo-Chine Suppl. 1: 759-781) increased the number to thirty-seven. In the same general area Craib in 1926 (Fl. Siam. Enum. 1: 277-278) recognized but five species from Siam. The number occurring in Burma is approximately fifteen. Hooker f. in 1875 (Fl. Brit. Ind. 1: 598-606) admitted twenty-four species for the area he covered (India proper, Ceylon, Burma, and the Malay Peninsula), but this number has now been increased for the area by perhaps fifteen or twenty species. Ridley in 1922 admitted seventeen species for the Malay Peninsula alone (Fl. Malay. Penin. 1: 437-442). For the Philippines, Merrill in 1922 (Enum. Philip. Fl. Pl. 1: 476-480) recognized twenty-one species, but undoubtedly some reductions remain to be made. In the Malay Archipelago, outside of the Philippines, the area extending from Sumatra and Borneo to New Guinea, about forty-five species have been described. Possibly a critical consideration of the Malaysian species will somewhat reduce this number, although from a cursory examination of available material from the Archipelago it seems apparent that a number of Malaysian species have as yet not been described; eventually the total may be increased rather than diminished.

Because of the characteristic local endemism of a high percentage of the Old World species of *Ilex* and the paucity of species of relatively wide distribution (and this applies to most of the species in the large genera of flowering plants for the entire Indo-Malaysian region), no general discussion of geographic distribution of the Malaysian species seems to be called for in this study of the Chinese forms. However, for all the species of British India, as I understand specific limits, only about seven extend to Southwest China, chiefly Yunnan Province; of the fifteen Burmese species, ten occur in China; of the thirty-seven Indo-Chinese species about twenty (many of them are new synonyms) extend to China. This relatively high percentage of species not confined to a single geographic area is understandable since northern Indo-China borders on southern China, and the boundary between the two countries is merely one of a political nature.

Again considering those areas more distant from China proper, of the five Siamese species two occur in Southwest China; only three of the seventeen Malay Peninsula species extend to China; only two of the twenty-one Philippine species have this range; and of the larger number of species (approximately forty-five) characteristic of the Malay Archipelago proper and New Guinea, only one is known to extend to China.

As Taiwan (Formosa) is now politically again a part of China, I have to the best of my ability considered the species of that island. A critical comparison of our somewhat inadequate Formosan collections with the vast amount of material available to me from China proper has led me to reduce a certain number of the proposed Formosan species to synonymy. As the island lies on the continental shelf, and as it was in geologic times immediately preceding the present undoubtedly a part of the continent, it is to be expected that the percentage of endemism for the Formosan flora would be reduced on the basis of critical comparisons as material became available for study. I have, in all, reduced eight of the proposed Formosan species to synonymy. It is expected that the same results will attain in other genera when it is possible to make critical comparisons of a considerable number of the described Formosan species with Chinese material. I note in passing that both low- and high-altitude species are involved among those Formosan species which I have reduced to earlier described continental species and varieties.

In this paper I have not considered the species of the Liukiu Islands and Japan except in those cases where species originally described from those areas have later been found on the continent. In the second edition of their *Flora of Japan* (1931) Makino and Nemoto treated forty-nine species of *Ilex* from Sakhalin, Japan, Liukiu, and Taiwan. In the Supplement Nemoto (1936) added nine more species to the flora of Japan. The lack of comprehensive collections from the area involved for purposes of comparison renders it unsafe for anyone to pass judgment on the validity of this or that species, except on the basis of a critical study of the types.

In citing the specimens the following abbreviations have been used: A = Arnold Arboretum, Harvard University; B = British Museum of



Natural History, London, England; CB = Cambridge Botanic Museum, Cambridge, England; CCC = Canton Christian College, Canton, China, now Lingnan University; G = Gray Herbarium, Harvard University; K = Royal Botanic Gardens, Kew, England; LU = Lingnan University, Canton, China; NY = New York Botanical Garden, New York, N. Y.; P = Muséum National d'Histoire Naturelle, Paris, France; SS = Biological Laboratories, Science Society of China, Nanking, China; Sz = College of Science, National Szechuan University, Chengtu, China; TU = National Taiwan University, Taipei, China; UN = University of Nanking, Nanking, China; US = United States National Herbarium, Washington, D. C.; UT = University of Tokyo, Japan.

### TAXONOMY

*Ilex* Linn. Sp. Pl. 125. 1753, Gen. Pl. ed. 5, 1754; DC. Prodr. 2: 13. 1825; Benth. & Hook. f., Gen. Pl. 1: 356. 1862; Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29(3): 14-53, *pl.* 1. 1881; Kronfeld in Engler & Prantl, Nat. Pflanzenfam. III, 5: 183. 1896; Loes. in Engler & Prantl, Nat. Pflanzenfam. Nachtr. 217. 1897, in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 8-500, *pl.* 1-15 (Monog. Aquif. 1:) 1901, 89: 20-312 (Monog. Aquif. 2:) 1908, in Sarg. Pl. Wils. 1: 67-82. 1911, in Engler & Prantl, Nat. Pflanzenfam. ed. 2, 20: 36. 1942; Comber in Notes Bot. Gard. Edinb. 18: 37-62. 1933.

Flower small, inconspicuous, regular, heteromorous, unisexual by abortion. Staminate flowers: calyx patelliform, 4-6-lobed; corolla rotate, with petals 4-8, slightly connate at the base; stamens usually as long as the petals, epipetalous; anthers oblong-ovate with rounded base; rudimentary ovary subglobose or frequently pulvinate, with a cleft beak, glabrous or puberulous. Pistillate flowers: 1-18-(usually 4-8)-merous; calyx persistent, 4-8-lobed. Petals connate at the base and spreading or distinct and suberect; staminodes epipetalous, small, half or two-thirds the length of the petals, the sterile anthers sagittate or cordate; ovary ovoid, 1-10-usually 4-8-loculate, glabrous or rarely pubescent; style rarely developed, stigma discoid, capitate or columnar. Fruit a baccho-drupe, usually globose, with a membranous or chartaceous exocarp, a fleshy mesocarp, and distinct coriaceous, woody or stony endocarps. Pyrenes (endocarps) 1-18, usually 4-6, smooth, striate, striate-sulcate or rugose and pitted, 1-seeded.

Dioecious trees or shrubs. Leaves alternate, rarely opposite, deciduous or evergreen, the margin entire, serrate or spinose, the stipules minute, callose, usually persistent. Inflorescences cymose, simple or much branched, solitary and axillary on the current year's growth or fasciculate and axillary on the second year's growth. Flowers white, pink, or red. Mature fruit red or black.

Over four hundred species distributed in the tropic, subtropic, and warm temperate zones of both hemispheres. One hundred and twelve species, belonging in two subgenera, *Prinos* and *Euilex*, occur in China. The two subgenera are well-marked groups and probably represent diverging evolu-

tionary lines within the genus. Which is the more primitive can be determined only after the genus has had a thorough anatomical and cytological study. I have placed *Prinos* before *Euilex* and so have departed from general practice. For publication of my paper this has been most practical. It does not imply necessarily that I believe *Prinos* to be the more primitive subgenus.

#### KEY TO THE SUBGENERA

- A. Deciduous trees or shrubs with membranaceous, chartaceous or rarely subcoriaceous leaves; branchlets usually with both elongated and abbreviated shoots; lenticels usually conspicuous on the current year's growth.....A. Subgenus *Prinos*.
- AA. Evergreen trees or shrubs with thick-coriaceous, coriaceous, or rarely chartaceous leaves; branchlets without abbreviated shoots; lenticels usually absent on the current year's growth.....B. Subgenus *Euilex*.

#### A. SUBGENUS PRINOS (LINN.) LOESENER

*Ilex* subgen. *Prinos* (Linn.) Loes. Vorst. Monog. Aquif.-Diss. 25, 26. 1890 "*Prinus*," in Verh. Bot. Ver. Brand. 33: 25, 26. 1891 "*Prinus*," in Engl. & Prantl, Nat. Pflanzenfam. Nachtr. 221. 1897, et in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 465 (Monog. Aquif. 1: 465). 1901 "*Prinus*"; Rehd., Man. Cult. Trees & Shrubs, ed. 2, 551. 1940, Bibl. Cult. Trees & Shrubs 402. 1949.

*Prinos* Linn. Sp. Pl. 330. 1753, Gen. Pl. ed. 5, 153. 1754.

Shrubs or trees usually with both elongated and abbreviated shoots, the lenticels usually conspicuous on the current year's growth; leaves deciduous, membranaceous or chartaceous, rarely subcoriaceous, the margin serrate or crenulate, rarely subentire, the pistillate inflorescence solitary.

#### KEY TO THE SECTIONS

- A. Mature fruit red; the pyrenes smooth with coriaceous, rarely woody, endocarp.
  - B. Branchlets with definite abbreviated shoots; fruit strongly depressed-globose with a capitate or cristate stigma, the style evident; pyrenes 6-13, longitudinally striate, the striae slightly impressed, the endocarp woody.....Sect. I. *Pseudoprinos*.
  - BB. Branchlets without abbreviated shoots; fruit globose, with a discoid stigma, the style lacking; pyrenes 4-8, smooth, not striate, the endocarp coriaceous.
    - C. Pistillate flowers in trichotomous cymes or pseudo-umbels; the inflorescence with 10 or more flowers.....Sect. II. *Micrococca*.
    - CC. Pistillate flowers solitary or in 2- or 3-flowered cymose or pseudofasciculate inflorescences.....Sect. III. *Euprinos*.
  - AA. Mature fruit black; the pyrenes rugose, striate, sulcate or canaliculate; the endocarp stony.....Sect. IV. *Prinoides*.

## SECTION I. PSEUDOPRINOS, SECT. NOV.

Frutices vel arbores parvae; ramulis elongatis abbreviatisque, lenticellis conspicuis; foliis membranaceis vel chartaceis, serratis; inflorescentiis paucifasciculatis vel solitariis; floribus 6-16-meris; ovario styliifero, stigmate capitato vel cristato; fructibus valde depresso-globosis; pyrenis 6-13, laevibus, striatis, endocarpio sublignescente.

One species in China.

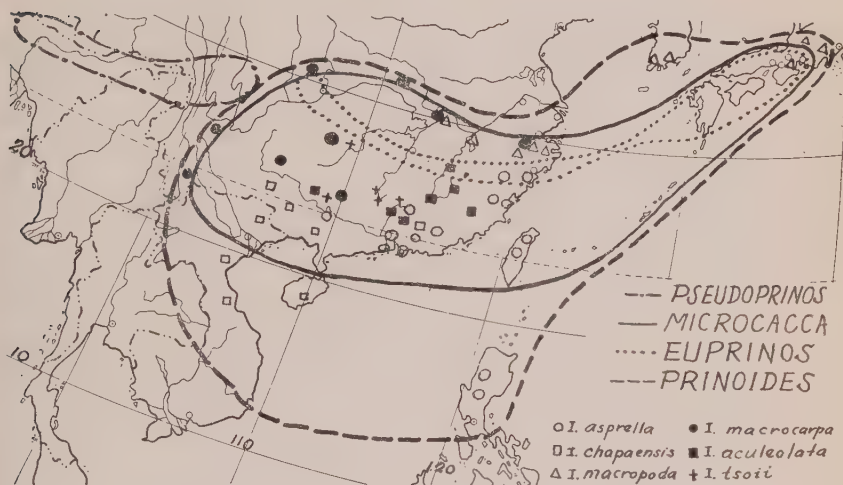


FIG. 4. Geographic distribution of the Eastern Asiatic representatives of the four sections of the subgenus *Prinos* with the species of the section *Prinoides* shown in detail.

1. *Ilex fragilis* Hook. f. forma *kingii* Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 493 (Monog. Aquif. 1: 493). 1901, in Sarg. Pl. Wils. 1: 82. 1911.

*Ilex burmanica* Merr. in Brittonia 4: 102. 1941. *Syn. nov.*

*Ilex opienensis* S. Y. Hu in Ic. Omei. 2: pl. 173. 1946. *Syn. nov.*

A deciduous shrub or small tree up to 5 m. high with both elongated and abbreviated branchlets, membranaceous or chartaceous ovate serrate leaves with pubescence beneath, very short pedicellate fruits with 6-13 small smooth striate woody pyrenes.

Branchlets castaneous or nigrescent; elongate shoots 7-15 cm. long or even longer, angular, smooth, shiny, rarely minutely puberulous in grooves below the terminal buds, otherwise glabrous, the lenticels conspicuous, elliptic, white, the terminal buds conic, with glabrous, strongly ciliate scales; abbreviated shoots 10-15 mm. long, very rugose with persistent bud-scales and leaf-scars; leaves 15-35 mm. apart on the elongated shoots, 1 or 2, rarely 3, crowded at the tip of the abbreviated shoots; stipules minute, broadly deltoid, persistent; petioles 6-12 mm. long, one-ninth to one-eighth

as long as the lamina, glabrous, narrowly canaliculate above, the distal end narrowly winged by the decurrent leaf-base; lamina chartaceous or membranous, olivaceous, opaque on both surfaces, hirsute along the veins on both surfaces, rarely glabrescent, ovate or ovate-elliptic, 5.5-14 cm. long, 2-5.5 cm. wide, rounded or obtuse at the base, acute or acuminate at the apex, the acumen 3-20 mm. long, serrate, the very tip cuspidate; the margin serrate, the teeth apiculate and nigrescent; midrib slightly impressed or plane, puberulent or glabrescent above, elevated and hirsute beneath, rarely glabrescent, the lateral nerves 8 or 9 pairs, slightly hirsute, rarely glabrescent beneath, the reticulations of the veinlets obscure above, evident beneath. Staminate inflorescence: fasciculate or solitary and axillary to scales or basal leaves of the elongate shoots, the individual branches of the fascicles uniflorous; pedicels 4-6 mm. long, glabrous; flowers 6-8-merous; the calyx patelliform, glabrous, 3 mm. across, deeply 6-8-lobed, the size and shape of lobes of the same flower varying greatly, 1 mm. long, ciliate, acute, rarely obtuse; corolla rotate, 6 mm. across, the petals oblong, 2 mm. long, very minutely ciliate, one-sixth connate at the base; stamens one-half the length of the petals, the anthers ovoid-oblong, 1 mm. long; rudimentary ovary pulvinate, depressed in the center. Pistillate inflorescence: solitary, axillary to the scales or rarely to the leaves; the pedicels 2-3 mm. long, up to 5 mm. long after fruiting, glabrous; flowers 6-16-merous; calyx patelliform, 4 mm. across, deeply 6-8-lobed, the lobes acute, 1 mm. long, ciliate; corolla subrotate, the petals oblong, 2 mm. long, one-eighth connate at the base; staminodes one-third as long as the petals, the sterile anthers cordate; ovary pulvinate, the style evident, up to 1.5 mm. long, glabrous or puberulous, the stigma capitate or comb-shaped. Fruit depressed-globose or discoid, 4 mm. long, 5-6 mm. in diameter, the persistent calyx explanate, the stigma discoid, capitate or cristate. Pyrenes 6-13, broadly elliptic or subglobose in outline, the ends obtuse, 2-2.5 mm. long, 1.5 mm. wide, smooth, longitudinally striate, the striae slightly impressed, the endocarp woody.

CHINA: Szechuan: Opien-hsien: *W. C. Cheng* 6129 (SS); *Y. S. Liu* 2233 (A); *C. W. Yao* 2739 (SS), 2803 (SS), 4320 (SS), 4327 (SS); *T. S. Chao* 148 (SS), 615 (SS), 734 (SS); Mt. Omei(?), *H. C. Chow* 12307 (A), 12321 (A); Wa-wu-shan, *E. H. Wilson* 892 (A), 334 (A); *C. W. Yao* 2306 (SS), 3766 (SS), 3842 (SS); Lung-an, *E. H. Wilson* 4580 (A). Sikang (Southeastern Tibet): Tsarong, *G. Forrest* 20298 (A), 21808 (A); *J. F. Rock* 10208 (A, US), 22015 (A, US), 22482 (A); Ta-chien-lu, *E. H. Wilson* 892A (A). Yunnan: *E. E. Maire* 44 (A); Wei-hsie, *J. F. Rock* 17058 (A, NY, US), 17168 (A, NY); Liang-shan, *H. T. Tsai* 51233 (A); Yi-liang-hsien, *H. T. Tsai* 52128 (A); Ping-pien-hsien, *H. T. Tsai* 62568 (A), 62680 (A); Salwin-Kiukiang Divide, *G. Forrest* 20298 (US), 21808 (US); *T. T. Yu* 19237 (A), 19289 (A), 20306 (A); Tarulaka, *T. T. Yu* 20920 (A).

UPPER BURMA: Adung Valley, *F. K. Ward* 9559 (TYPE of *Ilex burmanica*, A), 9583 (A).

INDIA: Sikkim, *J. D. Hooker* (fragment, A).



*Ilex fragilis* forma *kingii* is endemic to Eastern Himalaya. It is common on the high mountain of Sikkim, Upper Burma, and the Szechuan-Yunnan border. There it grows as a shrub or small tree in thickets or woods at altitudes of 1500–3000 m. The flowers appear in June, and the fruit turns red in October.

Both of Kingdon Ward's Specimens from Upper Burma are staminate flowering shoots. The leaves are still young and not fully expanded, hence they are smaller than those found on the fruiting specimens.

The membranaceous or chartaceous leaves, the variable number of carpels on one shoot, and the styliferous ovaries of *Ilex fragilis* indicate a close relationship with *Ilex macrocarpa* Oliv. The latter, however, has larger (over 10 mm. in diameter) fruits with ridged and canaliculate pyrenes. Nevertheless, the staminate branches of the two species are sometimes hard to distinguish. The short fruiting pedicels of *Ilex fragilis* suggest close relationship with *Ilex tsaii* Merr. & Chun, but the latter has deeply ridged stony pyrenes. When Loesener published the form *kingii* he doubted that this pubescent plant could be a juvenile form of *Ilex fragilis*. I have a fragment from Hooker's cotype (*Hooker & Thomson*, Khasia) in fruit. Its leaves are completely glabrous. At the same time I have *Wilson 892A* before me. The fruits of this specimen are mature, also. The lower surfaces of the leaves are pilose. I do not believe that the presence and absence of hairs in this case is correlated with age.

## SECTION II. MICROCOCCA (LOES.), STAT. NOV.

*Ilex* subgen. *Byronia* (Endl.) Loes. series B. *Micrococca* Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 91 (Monog. Aquif. 1: 91). 1901.

Large trees with conspicuous lenticels on the current year's growth, membranaceous or chartaceous serrate leaves, solitary trichotomous compound cymes or pseudo-umbels, small globose fruit, and 6–8 smooth longitudinally canaliculate pyrenes with coriaceous endocarp.

Two species in China.

## KEY TO THE SPECIES

- A. Inflorescence a compound trichotomous cyme with the secondary axis longer than the fruiting pedicels; leaves with 6–8 pairs of lateral nerves, the petioles plane above. (East and Southeast China).....2. *I. micrococca*.
- AA. Inflorescence a pseudo-umbel, the secondary axis usually lacking, when present shorter than the fruiting pedicels; leaves with 10–20 pairs of lateral nerves, the petioles canaliculate above. (West and South China).....3. *I. polyneura*.
2. *Ilex micrococca* Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29: 39, pl. 1, fig. 6. 1881; Loes. in Nov. Act. Acad. Leop.-Carol. Nat. Cur. 78: 91 (Monog. Aquif. 1: 91). 1901; Chung in Mem. Sci. Soc. China 1: 141. 1924; Anon. in Notes Bot. Gard. Edinb. 17: 115.

1926, 156, 268, 303, 365, 403. 1930; Merr. & Chun in Sunyats. 1: 68. 1930; Comber in Notes Bot. Gard. Edinb. 18: 55. 1933; Masamune Fl. Kainant. [Hainan] 174. 1943; Tardieu-Blot in Fl. Gén Indo-Chine Suppl. 1: 765. 1948.

*Ilex micrococca* var. *longifolia* Hayata Icon. Pl. Form. 3: 55, pl. 9. 1913; Kanehira, Formosan Trees 377, fig. 334. 1936. *Syn. nov.*

Tree up to 20 m. high with conspicuous lenticels on the current year's growth, the inflorescences cymose, trichotomous, solitary, with the secondary axis longer than the pedicels, the fruit globose, the pyrenes smooth with coriaceous endocarp.

Branchlets stout, very glabrous, second year's growth 1.5–5 mm. thick, cinereous-brunnescent, longitudinally plicate and rather rugose with conspicuous large circular or oblong, often coalescent white lenticels and slightly elevated obovate leaf-scars often united with the peduncle-scars immediately above them; current year's growth 2–4 mm. thick, shiny castaneous, with conspicuous white lenticels. Leaves occurring only on the current year's growth, 1–3 cm. apart; stipules minute, broadly deltoid, 0.2 mm. long, 0.3 mm. wide at the base; petioles slender, 1.5–3.2 cm. long, one-quarter to one-third the length of the lamina, plane above, plicate-rugose beneath, glabrous; lamina membranous or chartaceous, glabrous, olivaceous or brunnescent, dull above, paler beneath, ovate or ovate-elliptic, 7–13 cm. long, 3–5 cm. wide, rounded or obtuse and often oblique at the base, acuminate at the apex, the acumen 5–20 mm. long; margin subentire or sharply aristate-serrate; midrib plane and toward the base slightly sulcate above, prominent and elevated beneath, the lateral nerves 5–8 pairs, the tertiary veins prominent, the reticulations evident on both surfaces. Inflorescence cymose, solitary, or current year's growth only, axillary, twice or thrice trichotomous; bracts and bracteoles on the secondary axis lacking, the bract on the tertiary axis broad deltoid, minute, 0.4 mm. long, 0.5 mm. wide, acute, the bracts subtending the individual flowers very minute and warty; peduncle glabrous, longer than the secondary axis, 9–12 mm. long, plicate and in fruiting branches rugose; pedicels very short, 2–3 mm. long, shorter than the secondary axis, glabrous; prophylla 1 or 2, minute, warty, basal. Staminate flowers 5- or 6-merous; calyx patelliform, 2 mm. across, shallowly 5- or 6-lobed, the lobes obtuse, glabrous, eciliate or sparsely ciliate; corolla rotate, the petals oblong, 1.25 mm. long, one-third connate at the base; stamens equaling the petals in length, the anthers ovoid-oblong, 0.5 mm. long; rudimentary ovary subglobose, rostellate with a 0.5 mm. beak parted to the base. Pistillate flowers: 6–8-merous, very small, calyx patelliform, 2 mm. across, deeply 6-lobed, the lobes obtuse, ciliate; corolla rotate, 3 mm. in diameter, the petals oblong, 1 mm. long, one-fourth connate at the base; staminodes one-half as long as the petals, the sterile anthers sagittate; ovary conic-ovoid, 1 mm. in diameter, slightly constricted below the discoid stigma. Fruits globose, 3 mm. in diameter, the persistent calyx explanate, orbicular in outline, ciliate, the stigma thick-discoid, convex, distinctly

6-8-lobed. Pyrenes 6-8, minute, elliptic in outline, 2 mm. long, 1 mm. wide, the ends obtuse, the dorsal surface slightly roughened, longitudinally unicanaliculate, the sides smooth, the endocarp coriaceous.

CHINA: Chekiang: Sia-chu, R. C. Ching 1691 (LU, US), 1753 (US); Tai-sun, R. C. Ching 2181 (A, US). Kiangsi: Lu-shan, W. Y. Chun 4291 (A). Kwangtung: S. S. Sin 9513 (LU, NY); Sin-fung, Y. W. Taam 682 (A), 866 (A); Yu-yuen, S. P. Ko 52688 (A); Lo-chang, C. L. Tso 20773 (NY). Hainan: Fan-yah, N. K. Chun & C. L. Tso 44097 (A, NY, US). Taiwan: Lake Jitugetutan, Y. Kudo in 1929 (A); Taihoku, Nakamura 4055 (TU), E. H. Wilson 10784 (A); without precise locality, S. Susuki in 1925 (TU).

JAPAN: Hondo: Y. Okada 73 (A), 3913 (A).

*Ilex micrococca* was first described from material collected in Japan and is common in the coastal provinces of east and south China and the islands of Hainan and Taiwan, occurring also in Indo-China. It is a big tree up to 20 m. high. The white flowers appear in May, and by October its red fruit has fully matured.

## 2a. *Ilex micrococca* forma *pilosa*, f. nov.

*Ilex pseudogodajam* Franch. in Jour. de Bot. **12**: 256. 1898.

*Ilex micrococca* sensu S. Y. Hu in Ic. Pl. Omei. **2**: pl. 155. 1940, in part.

Arbor; pedicellis, calycibus et etiam foliis subtus pilosis.

CHINA: Hupei (Hupeh): Enshih, H. C. Chow 1840 (A); Chang-yang, E. H. Wilson 664 (A, B). Kweichow: Fan-ching-shan, Steward, Chiao & Cheo 713 (A, NY, US). Szechuan: Tchen-kéou-tin, R. P. Barges (P); Nan-chuan, W. P. Fang 5656 (A); Mt. Omei, T. S. Liu 1285 (A); T. C. Lee 4605 (Sz); W. P. Fang 15144 (Sz), 15548 (Sz), 15734 (Sz), 15576 (Sz), 19116 (Sz), 19164 (Sz); S. N. Hsu 691 (Sz); E. H. Wilson 3317 (K). Yunnan: An-ny-tsin, Ducloux 2775 (P); Sze-mao, A. Henry 11974A (NY); Meng-tze, A. Henry 13702 (NY); Y. Liu & C. W. Wang 85752 (A); Che-li, C. W. Wang 78193 (TYPE, A); Y. Liu & C. W. Wang 82895 (A); Ping-pien, H. T. Tsai 60843 (A); Delavay 6827 (A). Kwangtung: Lok-chong, L. C. Tso 20724 (NY), 20810 (NY). Kwangsi: N. Lu-chen, R. C. Ching 5900 (A, US), 6220 (NY); N. Hin-yen, R. C. Ching 6915 (LU); Chen-pien, S. P. Ko 55887 (A); On-Tak, S. P. Ko 55788 (A); Lin-yuin, Steward & Cheo 328 (A, NY), 316 (A, NY); Shang-sze, W. T. Tsang 22069 (A), 22145 (A), 24149 (A); Ping-nan, C. Wang 39316 (A), 39923 (A).

INDO-CHINA: Tonkin: W. T. Tsang 27284 (A), 29274 (A).

This variety differs from typical *Ilex micrococca* in having pubescent pedicels, calyces, and sometimes the branchlets and the lower surface of the leaves.

## 3. *Ilex polyneura* (Hand.-Mzt.), comb. nov.

*Ilex micrococca* Maxim. var. *polyneura* Hand.-Mzt. Symb. Sin. **7**: 654. 1933.

Tree up to 20 m. high (ex Yu), with conspicuous lenticels on current year's growth, chartaceous leaves, pseudo-umbelliform inflorescences, small

globose fruits, each with 6 or 7 pyrenes, the endocarp coriaceous, smooth and unicanalicate along the longitudinal median dorsal line.

Branchlets stout, very glabrous; second year's growth 3.5–4.5 mm. thick, cinereous-brunnescent, longitudinally plicate, the lenticels conspicuous, white, orbicular or oblong, the leaf-scars semi-orbicular, slightly elevated, closely associated with the oblong peduncle-scars; current year's growth glabrous, shiny, castaneous, 2–4 mm. thick, with conspicuous elliptic lenticels. Leaves occurring only on current year's growth, 5–15 mm. apart, the stipules scaly, rather large for the genus, 1.5 mm. long, 1 mm. wide; petioles one-fourth to one-third the length of the lamina, 1.5–2.8 cm. long, cylindric, deeply and narrowly canaliculate above, puberulent in the groove; lamina chartaceous or thin-coriaceous, glabrous above, minutely puberulent beneath, especially on the lateral nerves, olivaceous-brunnescent, oblong-elliptic, rarely ovate-elliptic, 8–15 cm. long, 3.5–6.5 cm. wide; rounded or obtuse, rarely oblique at the base, acuminate at the apex, the acumen 5–15 mm. long; margin finely and sharply serrate; midrib slightly impressed above, elevated beneath, the lateral nerves 11–20 pairs, plane above, elevated beneath, the tertiary nerves clear, the reticulation of the veinlets evident on both surfaces. Inflorescences pseudo-umbelliform, solitary, on the current year's growth, axillary, secondary axis usually not evident, but if developed, then shorter than the pedicels; peduncular bracts none, bracteoles subtending the individual flowers prophylla-like, basal, minute, broadly deltoid, brunnescent; peduncles slightly compressed, gradually enlarged at the distal end, 6–9 mm. long, puberulous; flowers 6- or 7-merous. Staminate flowers: pedicels 2–3 mm. long, puberulous, with 2 minute basal prophylla; calyx patelliform, 2 mm. across, deeply 6–7-lobed, the lobes deltoid, erose, eciliate; corolla rotate 4 mm. across, the petals ovate, 2 mm. long, one-fourth connate at the base; stamens equaling or slightly shorter than the petals, the anthers oblong 1 mm. long; rudimentary ovary pyramidal, 1 mm. long, the apex rostellate the beak cleft. Pistillate flowers: pedicels 3 mm. long, after fruiting 4–5 mm. long, with minute acute basal prophylla; calyx 2 mm. across, deeply 6- or 7-lobed, the lobes deltoid, acute, erose, eciliate, rarely minutely and sparsely ciliate; corolla rotate, 4 mm. across, the petals oblong, 1.5 mm. long, one-fifth connate at the base; staminodes very short one-half as long as the petals, the sterile anthers sagittate; ovary ovoid 2 mm. in diameter, the stigma discoid. Fruit globose, 4 mm. in diameter the persistent calyx 3 mm. across, the stigma discoid, convex. Pyrenes 7, small, elliptic in outline, 2–2.5 mm. long, 1 mm. wide on the back and narrowly unicanalicate along the longitudinal median line, the endocarp coriaceous.

CHINA: Sikang: Ya-an, *C. Y. Chiao* 1254 (A). Yunnan *Handel-Mazzetti* 8407 (A, US); Djiou-djiang, *Handel-Mazzetti* 9349 (A) Mengtze, *A. Henry* 10329A (B); Sze-mao, *A. Henry* 11953 (A); Tsingpian, *H. T. Tsai* 52526 (A); without precise locality, *G. Forrest* 8003 (A) 8651 (A), 16058 (A); Tsarong, *G. Forrest* 20823 (A, US), 21663 (A, US) 22824 (A), 26627 (A, US); Shang-pa, *H. T. Tsai* 54374 (A), 54810 (A)



58736 (A), 59041 (A); Ping-pien, *H. T. Tsai* 60434 (A); Kung-shan, *C. W. Wang* 66885 (A), 66913 (A); Fo-hai, *C. W. Wang* 77392 (A); Shun-ning, *T. T. Yu* 16010 (A), 16197 (A); Ai-wa, *T. T. Yu* 22879 (A); Salwin Valley, *T. T. Yu* 22918 (TYPE, A).

The description of the staminate flowers is drawn from *Handel-Mazzetti* 9349, and that of the pistillate flowers from *T. T. Yu* 16010.

This species has a limited range of distribution. It is found only in the mountainous area of western Yunnan and Sikang at altitudes of from 1500 to 2600 m. It flowers in May, and by December the fruits are mature. No leaves have been observed on twigs of the second year's growth. This may mean that the species is deciduous, or at least that the old leaves drop before the new ones develop.

In the color of the branchlets, the presence of white lenticels on the current year's growth, and the chartaceous leaves, *Ilex polyneura* resembles *Ilex micrococca* Maxim. These two species differ chiefly in their venation, petioles, and inflorescences. In *Ilex micrococca* the lateral nerves are 6-8 pairs, the petioles plane above, and the inflorescence twice or thrice trichotomous with prominent secondary axes which are always longer than the pedicels. In *Ilex polyneura* the lateral nerves vary from 11 to 20 pairs, the petioles are deeply and narrowly sulcate above, and the inflorescences are pseudo-umbelliform, but when secondary axes evolve, they are always shorter than the pedicels. The last character is constant. The differences impress me as sufficiently strong to warrant giving specific status to *Handel-Mazzetti's* variety.

### 3a. *Ilex polyneura* var. *glabra*, var. nov.

Arbor; ramulis glabris, castaneis, lenticellis conspicuis; foliis chartaceis vel membranaceis, 7-15 cm. longis, 3-7 cm. latis; inflorescentiis pseudo-umbelliformis, glabris; fructibus globosis.

CHINA: Yunnan: Mengtze, *A. Henry* 10329 (A, US), 10629C (A); Sze-mao, *A. Henry* 11953A (A), 11953B (A, US), 11953C (A, NY), 11953D (A); without precise locality, *G. Forrest* 11886 (A), 17981 (A), 18758 (A); Ta-li, *J. F. Rock* 6888 (A, NY); Tang-yueh, *J. F. Rock* 2709 (A, US); Shang-pa-hsien, *H. T. Tsai* 54500 (A), 54626 (A), 54701 (A), 58988 (A); Tsang-yuan, *C. W. Wang* 71396 (A); Chen-kang, *T. T. Yu* 17241 (A); Mien-ning, *T. T. Yu* 17879 (A); Champutong, *J. F. Rock* 10156 (A, NY, US), 11666 (A, US), 22061 (TYPE, A; NY); *T. T. Yu* 19166 (A); Tsarong, *G. Forrest* 19904 (A), 26652 (A, NY, US), 27417 (A).

This variety differs from typical *Ilex polyneura* in having glabrous leaves and inflorescences. It has been reported only from Yunnan, especially from the south and southwestern sections of that province. There it grows as a common tree. The greenish yellow flowers appear in June, and the fruit becomes scarlet in October.

## SECTION III. EUPRINOS LOESENER

*Ilex* subgen. *Prinos* Loes. sect. *Euprinos* Loes. in Engler & Prantl, Nat. Pflanzenfam. Nachtr. 221. 1897, in Nov. Act. Acad. Caes. Leop.-

Carol. Nat. Cur. 78: 465 (Monog. Aquifol. 1: 465). 1901 "Euprinus"; Rehd. Man. Cult. Trees Shrubs 551. 1940 "Euprinus," et Bibl. Cult. Trees Shrubs 402. 1949.

*Ageria* Adanson, Fam. Nat. Pl. 2: 166. 1763, pro parte.

*Prinos* Sect. *Ageria* (Adans.) DC. Prodr. 2: 17. 1825.

*Ilex* sect. *Prinos* (L.) Gray, Man. Bot. N. U. S. ed. 2, 264. 1856; Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29(3): 30. 1881.

Shrubs with membranaceous or chartaceous leaves, solitary or subfasciculate red fruits, and 4–6 smooth pyrenes with coriaceous endocarp.

One species in China.

4. *Ilex serrata* Thunb. var. *sieboldi* (Miq.) Rehd. in Bailey Cycl. Am. Hort. [2]: 798. 1900; Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 468 (Monog. Aquif. 1: 468). 1901 "Sieboldii"; Makino, Ill. Fl. Nip. 368, fig. 1102. 1940.

*Ilex sieboldi* Miq. in Versl. Med. Kon. Akad. Wet. II, 2: 84. 1868 [1866] (Repr. 19. 1866), et in Ann. Mus. Bot. Lugd.-Bat. 3: 104. 1867; Franch. & Sav. Enum. Pl. Jap. 1: 77. 1873; Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29: 30, 48. 1881; Nakagawa in Bot. Mag. (Tokyo) 13: 108. 1899.

*Ilex subtilis* Miq. in Versl. Med. Kon. Akad. Wet. II, 2: 84. 1868 [1866] (Repr. 19. 1866), et in Ann. Mus. Bot. Lugd.-Bat. 3: 107. 1867; Franch. & Sav. Enum. Pl. Jap. 1: 78. 1875.

*Ilex serrata* var. *subtilis* (Miq.) Yatabe in Bot. Mag. (Tokyo) 62: 158. 1892; Loes. op. cit. 469 (1901); Koidz. Fl. Symb. Orient.-As. 8. 1930. *Syn. nov.*

A very pubescent deciduous shrub 1–2.5 m. high with hirsute branchlets, conspicuous lenticels, elliptic densely and argutely serrate leaves, solitary cymose inflorescences borne behind an axillary bud on the current year's growth, short-pedicellate fruit, and 4–6 smooth pyrenes.

Branchlets subterete, cinereous, hirsute; third year's growth 3–4 mm. in diameter, longitudinally rimulose, the lenticels numerous, circular, leaf-scars semi-orbicular, not elevated; second year's growth 3–3.5 mm. in diameter, puberulous, the lenticels conspicuous; the current year's growth 1.5–2.5 mm. in diameter, hirsute, longitudinally plicate-canaliculate, the lenticels conspicuous, the terminal buds ovoid, with puberulous and crisply ciliate scales. Leaves occurring only on current year's growth, expanding a little before or during anthesis, 8–14, rarely 20 mm. apart; the stipules linear, 2 mm. long, pilose, caducous; petioles 6–8 mm. long, one-tenth to one-sixth the length of the lamina, plicate-rugose and hirsute, deeply canaliculate above; lamina membranaceous, griseous-olivaceous, sometimes brunnaceous, hirsute on both surfaces, elliptic, rarely ovate- or obovate-elliptic, 2–8.5 cm. long, 1–4 cm. wide (usually 5 cm. long, 2 cm. wide), acute or rarely obtuse at the base, shortly acuminate or rarely acute at the apex, the acumen 3–5 mm. long, the very tip mucronate; margin densely and argutely serrate; midrib elevated on both surfaces, hirsute, the lateral nerves 6–8 pairs, obscure above, prominent beneath, hirsute on both surfaces, the reticulation of the veinlets prominent beneath,

hirsute. Inflorescences essentially cymose, solitary, on current year's growth, always behind an axillary bud, hirsute, very rarely subfasciculate in the pistillate. Staminate inflorescences: cymes twice or thrice dichotomous or trichotomous, 9–21-flowered; peduncles 3 mm. long, the secondary axis 1.5 mm. long, the pedicels 2–2.5 mm. long, with scale-like minute deltoid basal prophylla; flowers 4- or 5-merous; calyx patelliform, 1.5–2 mm. across, deeply 4- or 5-lobed, the lobes deltoid, obtuse or rounded, hirsute and ciliate; corolla rotate, 4.5 mm. across, the petals oblong, erose, eciliate, one-tenth connate at the base; stamens slightly shorter than the petals, the anthers oblong, 1.25 mm. long; rudimentary ovary narrowly conic, 0.75 mm. long, acute at the apex, glabrous. Pistillate inflorescences: cymes with 1–3 flowers, the peduncles 0–1.5 mm. long, the pedicels 2–3 mm. long; flowers 4–6-merous; calyx as in the staminate flowers; corolla rotate, 4.5 mm. in diameter, the petals ovate, erose, one-eighth connate at the base; staminodes one-half as long as the petals, the sterile anthers sagittate, obtuse at the apex; ovary ovoid, 1.5 mm. in diameter, glabrous, the stigma discoid. Fruit globose, 5 mm. in diameter, solitary or 2 or 3 in a simple cyme, pedicels less in length than the diameter of the fruit, 2–2.5 mm. long, hirsute, the prophylla sub-basal, persistent, explanate, suborbicular in outline, 5- or 6-lobed, the lobes round, hirsute and ciliate, the stigma discoid, 5- or 6-lobed. Pyrenes 4 or 5, rarely 6, broadly elliptic in outline, 2–2.3 mm. long, 1–1.25 mm. wide, smooth, estriate-esulcate, the endocarp coriaceous.

CHINA: Chekiang: Ching-yuen, *R. C. Ching* 2324 (A). Hunan: Changsa, *Y. Lin* in 1947 (A), in 1948 (A). Szechuan: Kia-ting, *E. H. Wilson* 3519 (A).

JAPAN: *P. H. Dorsett & W. J. Morse* 1450 (A); *U. Faurie* 88 (A), 6119 (A); *J. G. Jack* in 1905 (G); *Maximowicz* in 1862 (NY); *N. Mochizuki* in 1904 (G); *Siebold* (TYPE of *Ilex serrata* var. *subtilis*, fragment, A); *K. Shiota* 6663 (A); *E. H. Wilson* 7043 (A), 7555 (G); *K. Watanabe* in 1892 (G).

CULTIVATED: Europe: Germany, Botanical Garden Darmstadt, *J. A. Purpus* (A). America: United States, Arnold Arboretum 892, 385 (A).

*Ilex serrata* var. *sieboldi* is common in Japan. It differs from typical *Ilex serrata* Thunb. in having hirsute leaf-surfaces. Specimens which match perfectly the Japanese specimens have been collected at several places in China.

I am treating *Ilex sieboldi* Miq. as only a variety of *Ilex serrata* Thunb. It appears to differ from the Thunbergian species only in having hirsute leaf-surfaces. After examining all the available Asiatic material of *Ilex serrata*, I believe that to be essentially a pubescent species. None of the specimens has completely glabrous branchlets as stated by Thunberg, "Rami teretes, laeves, glabri." In fact, many of them have pubescent midribs, and all of them have puberulent pedicels. Nowhere in his description did Thunberg mention the presence of hairs on the branchlets, leaves, or inflorescences. Since I have not seen Thunberg's original

specimen, I have followed his description and treated the Japanese plant with sparsely puberulous branchlets, glabrous or glabrescent petioles and lamina as typical *Ilex serrata*.

Miquel based his description of *Ilex subtilis* on a juvenile branch with unfolding buds in which the leaves were not fully expanded. A fragment of the type is in the Arnold Arboretum. It is certainly a juvenile form of *Ilex serrata* var. *sieboldi*.

*Ilex serrata* Thunb. and *Ilex verticillata* Gray, the latter a North American species of deciduous holly, are alike in their crisply hirsute indumentum, their membranaceous or thinly chartaceous argutely serrate leaves, their solitary, rarely 2- or 3-flowered infructescences, their ciliate calyx and their smooth coriaceous pyrenes. The latter species differs in having 6-9-merous flowers. The texture of the leaves, the shortly pedicellate infructescences, and the indumentum of *Ilex serrata* var. *sieboldi* also simulate *Ilex pubescens* Hook. & Arn. of China, but the latter has fasciculate inflorescences on the old growth, a styliiferous ovary, and striate and sulcate woody pyrenes.

#### SECTION IV. PRINOIDES (DC.) GRAY

*Ilex* subgen. *Prinos* Loes. sect. *Prinoides* (DC.) Gray, Man. Bot. N. U. S., ed. 2, 264. 1856; Loes. in Engl. & Prantl, Nat. Pflanzenfam. Nachtr. 221. 1897, et in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 476 (Monog. Aquif. 1: 476). 1901; Rehd. Man. Cult. Trees Shrubs ed. 2, 552. 1940, et Bibl. Cult. Trees Shrubs 403. 1949.

*Prinos* sect. *Prinoides* DC. Prodr. 2: 16. 1825.

Deciduous trees or shrubs with chartaceous, membranaceous or subcoriaceous leaves, black mature fruit, 4-9 rugose, striate, sulcate, or 2-canaliculate pyrenes with stony endocarp.

#### KEY TO THE SPECIES

- A. Pyrenes 3-ridged and deeply canaliculate on the dorsal surfaces; fruit with capitate or columnar stigma, the style evident.
  - B. Leaves small, (3-)4-5(-7). cm. long; fruit 5-6 mm. in diameter; pedicels slender, 5 or 6 times as long as the diameter of the fruit; stigma capitate. (East and South China and the near-by islands) .....5. *I. asprella*.
  - BB. Leaves large (5-)7-10(-15) cm. long; fruit 12-14 mm. in diameter; pedicels never as much as 3 times as long as the diameter of the fruit; stigma columnar.
    - C. Rudimentary ovary pulvinate, with slightly depressed center; pyrenes 7-9, laterally much compressed, the dorsal surface 1-2 mm. wide; style glabrous. (West, southwest, central, and east China) .....6. *I. macrocarpa*.
    - CC. Rudimentary ovary conic with a rostellate apex; pyrenes 6 or 7, the dorsal surface 4 mm. wide; style puberulous. (South China and Indo-China) .....7. *I. chapaensis*.



- AA. Pyrenes striate and sulcate, the striae of the dorsal surface often reticulate; fruit with discoid (sometimes capitate in *I. tsoii*) stigma, the style lacking.
- B. Leaves obovate, (2-)3-4(-5) cm. long, cuneate at the base; pyrenes 4.....8. *I. aculeolata*.
- BB. Leaves ovate or ovate-elliptic, (4-)6-8(-10) cm. long with rounded base; pyrenes 5 or 6.
- C. Fruiting pedicels 6-7 mm. long; pyrenes 5; calyx 2.5 mm. across; leaves with obscure reticulations on the upper surface. (East and Central China and Japan).....9. *I. macropoda*.
- CC. Fruiting pedicels 2-3 mm. long; pyrenes 6; calyx 4 mm. across; leaves with sharply defined areoles on both surfaces. (East, central, and south China).....10. *I. tsoii*.

5. *Ilex asprella* (Hook. & Arn.) Champ. ex Benth. in Hook. Jour. Bot. Kew Gard. Misc. 4: 329. 1852; Benth. Fl. Hongkong 65. 1861; Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29: 49. 1881; Forbes & Hemsl. in Jour. Linn. Soc. Bot. 23: 115. 1886; Henry in Transact. As. Soc. Jap. 24 (Suppl.): 26. 1896; Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 477 (Monog. Aquif. 1: 477). 1901; Dunn & Tutcher in Kew Bull. Misc. Inf. Add. Ser. 10: 60. 1912; Merr. in Sunyats. 1: 22. 1930.

*Prinos asprellus* Hook. & Arn. Bot. Beech. Voy. 176, pl. 36, figs. 1, 2. 1833; Walp. Rep. 1: 541. 1842.

*Ilex oxyphylla* Miq. in Jour. Bot. Neerl. 1: 124. 1861; Forbes & Hemsl. in Jour. Linn. Soc. Bot. 23: 117. 1886.

*Ilex gracilipes* Merr. in Philip. Jour. Sci. Bot. 3: 237. 1908, 5: 358. 1910; Elm. Leaf. Philip. Bot. 5: 1664. 1913.

*Ilex merrillii* Briq. in Ann. Conserv. Jard. Bot. Genève 20: 421. 1919.

A deciduous shrub up to 3 m. high with slender elongate and short abbreviated branchlets, membranaceous ovate acuminate serrate leaves, long-pedicellate solitary fruits and 4-6 ridged and deeply sulcate bony pyrenes.

Branchlets glabrous, castaneous, the lenticels on older portions conspicuous and numerous; elongated shoots slender, the third year's growth 1.5-2 mm. in diameter, the lenticels lacking, the second year's growth 1 mm. in diameter, the current year's growth 0.7 mm. in diameter, all glabrous, the abbreviated shoots 3-15 mm. long, rugose with persistent bud-scales and scars, the terminal buds very narrowly conic, acute, glabrous. Leaves 5-10 mm. apart on elongated shoots or 1-4 crowded at the tips of abbreviated shoots; stipules callose, deltoid, acute, persistent; petioles 3-8 mm. long, one-ninth to one-sixth the length of the lamina, narrowly canaliculate and sparsely puberulent above, the rest glabrous; lamina membranaceous, olivaceous, opaque on both surfaces, minutely pubescent above (sometimes only on the veins), glabrous beneath, ovate or ovate-elliptic, 3-7 cm. long, 1.5-3 cm. wide, obtuse, rarely rounded, or acute at the base, acuminate at the apex, the acumen 3-12 mm. long, serrulate on the basal portion, the very tips acute or mucronate; margin serrate; midrib slightly impressed and hirsute above, elevated and glabrous

beneath, the lateral nerves 6–8 pairs, evident and hirsute above, evident and glabrous beneath, the reticulation of the veinlets obscure. Staminate inflorescences: paucifasciculate with 2 or 3 flowers or solitary, axillary to the leaves or scales, when axillary to the leaves often behind an axillary bud; pedicels (3–) 5–6 (–9) mm. long; flowers 4- or 5-merous; calyx patelliform, 2.5–3 mm. across, glabrous, shallowly 4- or 5-lobed, the lobes unequal, broadly deltoid or rounded, erose and ciliate; corolla rotate, 6 mm. across, the petals 4 or 5, suborbicular, 2 mm. in diameter, rarely ciliate, one-fifth connate at the base; stamens 4 or 5, three-fourths as long as the petals, the anthers oblong, 1 mm. long; rudimentary ovary pulvinate, the middle shortly rostellate. Pistillate inflorescences: solitary, axillary to the leaves; pedicels 2–2.5 cm. long, after fruiting up to 3 cm. long, glabrous, with 2 minute basal prophylla; flowers 4–6-merous; calyx 3 mm. across, deeply 4–6-lobed, the lobes ciliate; corolla rotate, the petals suborbicular, 2 mm. in diameter, one-fourth connate at the base; staminodes one-half the length of the petals, the sterile anthers sagittate; ovary subglobose-ovoid, 1.5 mm. in diameter, the style evident, the stigma thickly discoid. Fruit globose, 5–6 mm. in diameter, longitudinally striate and sulcate, the persistent calyx explanate, 3 mm. across, suborbicular in outline, ciliate, the stigma capitate, the style evident. Pyrenes 4–6, obovate-elliptic in outline, the ends obtuse, 5 mm. long, 2 mm. wide, 3-striate, ridged, canaliculate, the sides almost smooth, striate, the ventral keel sharp, the endocarp stony.

CHINA: Chekiang: Sia-chu, R. C. Ching 2210 (A, LU, US); Tai-shun, Y. L. Keng 267 (A). Kiangsi: Woo-kung-shan, H. H. Hu 758 (A); Tsu-chi-hsien, H. H. Hu 1247 (A); Tsoong-jen, Y. Tsiang 10218 (NY). Fukien: Central Fukien, Dunn (Herb. Hongk. no. 2463) (A); Chang-chow, H. H. Chung 1187 (A), 1214 (A, LU); Ing-hok, H. H. Chung 2621 (A), 3227 (A), 7988 (A); Yeng-ping, H. H. Chung 3354 (A); Ku-tien, H. H. Chung 4030 (A); Ku-liang, H. H. Chung 6776 (A, LU); Ku-dien, H. H. Chung 7920 (A); Foochow, H. H. Chung 8916 (A, LU, NY); F. P. Metcalf 845 (LU), 3518 (A, LU); Tang Siu-ying 13948 (LU), 15579 (LU), 15600 (LU). Kwangtung: Canton, C. O. Levine (CCC) 437 (US), 478 (A, US), 638 (A, US), 2102 (A); Mei-hsien, J. L. Gressitt 1205 (A), 1324 (A); Tung-wan, S. Y. Lau 20040 (LU, NY); Chung-shan, Fung-hom 24 (LU 18449) (NY); W. T. Tsang (LU 19242) (NY); Fung & McClure 19 (LU 19328) (NY); Loh-fau-shan, E. D. Merrill 10728 (A); Wai-yang, T. M. Tsui 146 (A, NY, US); San-on, T. M. Tsui 195 (US); Ying-tak, T. M. Tsui 317 (A, NY, US); Ta-pu, W. T. Tsang 21081 (A, NY); 21752 (A, NY); Ho-yuen, W. T. Tsang 28707 (A); Sin-tong, Ko-chow, Y. Tsiang 969 (A); Lo-fou-shan, Y. Tsiang 1689 (A); Lui-chow, Y. Tsiang 2208 (NY), 2558 (NY); Kwu-dzu, Tse-kung C. L. Tso 41473 (NY); Sun-wui, Tso & Tsiang 2019 (A). Kwangsi: Tang-hsien, G. W. Groff (CCC) 4135 (LU). Hongkong: Hongkong New Territory, W. Y. Chun 6250 (A); without precise locality, Faber 116 (A); Aberdeen, Y. W. Taam 1988 (A); Bridge Valley, Y. Tsiang 63 (A); Hwang-tso-kong, Y. Tsiang 617 (A, NY); without precise locality, C. Wright (NY). Taiwan: U. Faurie 125 (A); T. Hayashi 21216 (A); A. Henry 221 (A, NY), 254 (A), 572 (A, NY),

1334 (US); *T. Hosokawa* 9893 (TU); *J. L. Gressitt* 86 (A, NY); *E. Matuda* 44 (A); *T. Nonaka & K. Mori* in 1932 (TU); *S. Sasaki* 21569 (A); *H. Simada* 335 (TU); *S. Suzuki* in 1931 (A); *T. Suzuki* in 1933 (TU); *T. Tanaka* 76 (A, NY); *T. Tanaka & Y. Shimada* (Herb. no. 11009) (NY, US), (Herb. no. 11094) (A, NY, US); *E. H. Wilson* 10065 (A, US), 10293 (A, US), 11186 (A).

*Ilex asprella* is a wide-spread deciduous species in the coastal provinces of warm temperate and subtropical China including Taiwan (Formosa) where it occurs at low altitudes. The white flowers appear in March, and the fruit turns black in October. It is common in Taiwan and extends to the Philippine Islands where it occurs at altitudes of from 1200 to 1900 meters. It is the only deciduous species of *Ilex* known from the Philippines and there it flowers also in March. I agree with Merrill in his reduction of *Ilex gracilipes* Merr. and *Ilex merrillii* Briq. as synonyms of the common Chinese species. Among the many Philippine collections I may cite *Clemens* 51888; *D. E. Elmer* 9515A, 14297; *E. C. Leano* 22914; *A. Loher* 13020; *Ramos & Edano* 38079, 45061, 47271; *J. K. Santos* 7 and 31735; all specimens seen in the Arnold Arboretum.

In its membranaceous leaves and its solitary staminate or pistillate flowers, each behind an axillary bud on elongated branchlets, *Ilex asprella* shows close relationship with *Ilex serrata* Thunb. The latter, however, has smooth pyrenes and small, shortly pedicellate fruits. The texture of the leaves and the sculpturing of the pyrenes of *Ilex asprella* show close relationship with *Ilex aculeolata* Nakai, but the latter has obovate leaves and very shortly pedicellate fruits.

5a. *Ilex asprella* var. *tapuensis*, var. nov.

Frutex; ramulis glabris; foliis membranaceis, ovato-ellipticis, 4–8 cm. longis, 1.7–3.4 cm. latis, basi obtusis vel rotundatis, apice acuminatis, acuminibus 3–15 mm. longis, mucronatis, costa supra impressa et puberula; inflorescentiis fructiferis solitariis, pedicellis 2 cm. longis, glabris; fructibus ellipsoideis, 9 mm. longis, 8 mm. diametro, calycibus persistentibus sub-explanatis, 4 mm. diametro, ciliatis; stigmatibus crasse discoideo; pyrenis 6, 8 mm. longis, 3 mm. latis, dorso 3-striatis, 2-canaliculatis, lateralibus 1- vel 2-striatis et sulcatis, endocarpio lapideo.

CHINA: Kwangtung: Ta-pu, *W. T. Tsang* 21245 (TYPE, A; K).

The only specimen we have seen was collected at Ta-pu, E. Kwangtung. There the plant grows as a shrub up to 3 m. high. The fruit is black at maturity.

This variety could be either a form of *Ilex macrocarpa* Oliv. var. *longipedunculata* S. Y. Hu with small leaves and fruit or a large-fruited variety of *Ilex asprella*. I prefer the latter position, since the fruit lacks the characteristic columnar stigma of *Ilex macrocarpa* Oliv.

6. *Ilex macrocarpa* Oliv. in Hook. Ic. Pl. 8: pl. 1787. 1888; Loes. ex Diels in Bot. Jahrb. 29: 436. 1900, in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 489 (Monog. Aquif. 1: 489). 1901; Pamp. in Nuov. Giorn. Bot. Ital. n. s. 17: 147. 1900; Dunn & Tutchener in

Kew Bull. Misc. Inf. Add. Ser. 10: 60. 1912; Loes. in Sarg. Pl. Wils. 1: 81. 1911; Pamp. in Nuov. Giorn. Bot. Ital. n. s. 17: 417. 1910; Rehd. in Jour. Arnold Arb. 8: 158. 1927, 14: 242. 1933; Chun in Sunyats. 1: 181. 1933; Hand.-Mzt. Symb. Sin. 7: 659. 1933; Comber in Notes Bot. Gard. Edinb. 18: 54. 1933; Tardieu-Blot in Fl. Gén. Indo-Chine Suppl. 1: 780. 1948.

*Ilex henryi* Loes. in Nov. Act. Acad. Caes. Leop.-Carol. 78: 491 (Monog. Aquif. 1: 491). 1901. *Syn. nov.*

*Ilex macrocarpa* Oliv. var. *trichophylla* Loes. Il.cc. 491. 1901, 81. 1913. *Syn. nov.*

*Ilex macrocarpa* Oliv. var. *genuina* Loes. Il.cc.; Comber in Notes Bot. Gard. Edinb. 18: 54. 1933. *Syn. nov.*

*Ilex dubia* (G. Don) Trel. var. *hupehensis* Loes. l.c. 488. 1901. *Syn. nov.*

*Ilex montana* Torr. & Gray var. *hupehensis* Fern. in Rhodora 41: 428. 1933. *Syn. nov.*

*Celastrus salicifolia* H. Lévl. in Fedde, Rep. Spec. Nov. 13: 263. 1914.

*Diospyros Bodinieri* H. Lévl. Fl. Kouy-Tchéou. 144. 1914.

*Ilex macrocarpa* Oliv. var. *brevipedunculata* S. Y. Hu in Ic. Pl. Omei. 2: pl. 171. 1946. *Syn. nov.*

A deciduous tree with both elongated and abbreviated branchlets, ovate, ovate-elliptic, or rarely oblong-elliptic leaves, solitary or pseudofasciculate staminate inflorescences, solitary large fruits with 5-9 laterally compressed striate-sulcate pyrenes.

Branchlets brunneous; third and second years' growth 3 mm. in diameter, the lenticels orbicular, conspicuous; current year's growth glabrous, 2-3 mm. in diameter, the lenticels evident, the terminal buds subglobose-conic, glabrous; abbreviated shoots weakly developed, 3-10 mm. long. Leaves 10-30 mm. apart on elongated shoots, 1-3 crowded at the tips of the abbreviated shoots; stipules very minute, callose, often obscure; petioles 9-12 mm. long, one-tenth to one-seventh the length of the lamina, narrowly canaliculate and minutely puberulous above; lamina chartaceous, olivaceous, opaque on both surfaces, glabrous, glabrescent, or when young minutely and sparsely pubescent, ovate, ovate-elliptic or rarely oblong-elliptic, 5-15 cm. long, 3-7 cm. wide, rounded or obtuse at the base, shortly acuminate at the apex, the acumen 3-10 mm. long; margin serrate, midrib impressed and usually minutely puberulous above, elevated, glabrous, glabrescent or sparsely puberulous beneath, the reticulations of the veinlets prominent on both surfaces. Staminate inflorescences: pseudofasciculate on second year's growth of elongated shoots and on abbreviated shoots, or solitary, axillary to the basal scales or leaves of elongated shoots, 1- to 5-flowered, cymose; peduncles 2-4 mm. long, the pedicels 2-7 mm. long, both glabrous; flowers 5- or 6-merous; calyx patelliform, ca. 3 mm. across, shallowly 5- or 6-lobed, the lobes deltoid-ovate, obtuse or rounded, ciliate; corolla rotate, 7 mm. across, the petals obovate-oblong, 3 mm. long, ciliate, one-sixth connate at the base; stamens equaling the petals in length, the anthers ovate-oblong, 1 mm. long; rudimentary ovary pulvinate, the center slightly depressed, inconspicuously lobed. Pistillate inflorescences: solitary,



axillary; pedicels 6–14 mm. long, glabrous, with 2 sub-basal prophylla; flowers 7–9-merous; calyx patelliform, 5 mm. across, shallowly 7–9-lobed, the lobes ovate-deltoid with obtuse or rounded apex, ciliate; corolla rotate, 10–12 mm. across, the petals 4–5 mm. long, one-fifth connate at the base; staminodes two-thirds as long as the petals, the sterile anthers sagittate, the apical end obtuse; ovary conical-ovoid, 2 mm. long, 3 mm. in diameter at the base, the style evident, 1–1.5 mm. long, the stigma columnar, 1.5 mm. long, glabrous. Fruit globose, 12–14 mm. in diameter, the persistent calyx explanate, 6 mm. in diameter, orbicular in outline, the stigma columnar, 2 mm. long. Pyrenes 7–9, laterally compressed, the ends obtuse, 9 mm. long, 2 mm. wide, on the dorsal surface longitudinally ridged and deeply canaliculate, reticulately striate and sulcate on the sides, the endocarp stony.

CHINA: Anhwei: Chu-hwa-shan, *R. C. Ching* 2722 (A), 2732 (A), 2750 (A, LU). Hupei (Hupeh): *A. Henry* 2891 (ISOTYPE, A), 3445 (G), 3451 (A, US), 4179 (A), 6214 (ISOTYPE of *Ilex dubia* var. *hupehensis*, US), 4633 (ISOTYPE, NY), 7382 (A), 7720 (US); Chang-yang-hsien, *E. H. Wilson* 151 (A, US); without precise locality, *E. H. Wilson* 250 (NY), 2695 (NY, US); Pa-tung-hsien, *E. H. Wilson* 3089 (A, US). Hunan: *Handel-Mazzetti* 575 (A). Kweichow: *J. Esquirol* in 1906 (TYPE of *Celastrus salicifolia*, photo & fragment, A), 6094 (A, P); *J. Chaffanjon* in 1898 (fragment of type of *Diospyros Bodinieri*, A); Ta-ting, *Y. Tsiang* 8906 (NY). Szechuan: Chien-yang-hsien, *S. S. Chien* 5249 (A, SS); without precise locality *E. Faber* 27 (NY); Tchen-kéou-tin, *R. P. Farges* 1397 (A, P); Mt. Omei, *C. Y. Chiao* & *S. C. Fan* 82 (A), 115 (A); *S. S. Chien* 5475 (Sz); *H. C. Chow* 5842 (Sz), 5882 (Sz), 5883 (Sz), 5897 (Sz), 5962 (Sz), 7626 (A, Sz), 7811 (A, Sz), 8247 (A, Sz), 9728 (Sz), 11741 (A); *W. P. Fang* 2342 (A), 2388 (A, NY, SS), 2398 (A), 3208 (A, NY), 7389 (US), 12236 (SS), 12576 (SS), 14163 (Sz), 14484 (Sz), 14825 (Sz), 16421 (Sz), 16473 (Sz), 16663 (Sz), 16976 (Sz), 17251 (Sz), 17281 (Sz), 17470 (Sz), 18757 (Sz), 18824 (Sz), 18895 (Sz); *T. C. Lee* 3137 (Sz), 3328 (Sz); *Y. L. Liu* 1024 (A); *C. L. Sun* 1898 (Sz), 1989 (Sz), 2067 (Sz); *L. Y. Tai* 411 (A); *K. Y. Yao* 3320 (SS), 3255 (SS); *C. W. Yao* 2723 (SS); *T. T. Yu* 568 (A); Kwan-hsien, *S. S. Chien* 5597 (Sz), 5761 (Sz); *W. P. Fang* 1959 (A); *F. T. Wang* 20797 (A); Chengtu, *S. S. Chien* 5255 (Sz), *W. P. Fang* 12228 (A, SS, US), 12236 (A, SS), 13385 (SS), 19286 (Sz); *C. Y. Wang* 7293 (Sz); *E. H. Wilson* 4795 (K); An-hsien, *F. T. Wang* 22188 (A), 22208 (A); Lo-shan-hsien (Kia-ting), *H. C. Chow* 9649 (A); *H. H. Chung* 216 (A); *S. C. Sun* & *K. Chang* 820 (A); *H. H. Tai* 5 (A); *L. Y. Tai* 825 (A), 1212 (A); *F. T. Wang* 23553 (A); *T. T. Yu* 218 (A); Opien-hsien, *S. N. Hsu* 30 (SS); *E. H. Wilson* 250 (A, US), 3088 (A), 4795 (A). Yunnan: *F. Ducloux* 6657 (A, P); without precise locality, *E. E. Maire* 1487 (K, US); Mi-le, *A. Henry* 10308 (A, US); Yantai-hsien, *H. T. Tsai* 50810 (A); Hsi-lung-tang, Chang-kiang, *Y. Tsiang* & *H. Wang* 16243 (A), 16244 (A); *H. Wang* 41495 (A); Kun-ming, *C. W. Wang* 62807 (A), 62843 (A). Kwangtung: Tai-Yong, *J. L. Gressitt* 1736 (A); Yao-shan, N. River, *S. S. Sun* 9805 (NY); Sun-yi, *Y. Tsiang* 2660 (NY). Kwangsi: Luchow, *R. C. Ching* 5350 (NY).

CULTIVATED: I have seen specimens collected from the Arboretum of "Westonbirt, Glos," England.

*Ilex macrocarpa* was first described from material said to have been collected in Hupeh and Hongkong. In all the material we have studied there is no representative from Hongkong. Dunn & Tutcher in Kew Bull. Misc. Inf. Add. Ser. 10: 60. 1912, and Tutcher in Rep. Bot. For. Dept. Hongk. Suppl. 20. 1916 may have copied Oliver's error. *Ilex macrocarpa* is essentially a tree of the warm temperate forests or woods and thickets of the Yangtze Provinces. There its white and fragrant flowers appear in April. The fruit turns black in November and is eaten by various birds, especially the common white-head bulbul. Possibly birds have aided in the dissemination of this widely distributed species.

*Ilex macrocarpa* is closely related to *Ilex chapaensis* Merr., but the latter has rostellate rudimentary ovaries, trigonous pyrenes, and thick-chartaceous leaves, often with shiny upper surfaces.

After examining many specimens from different parts of China, it is evident that *Ilex macrocarpa* is a very variable species. The indumentum of the leaves, for example, varies considerably. Usually the blade of the leaf is pubescent along the midrib on the upper surface, but in some plants the blade is entirely glabrous and in others pubescent on both upper and lower surfaces. The staminate inflorescences vary from solitary cymes on vigorously growing young shoots to pseudofasciculate on older shoots. The fruiting pedicels vary in length from those that are slightly shorter than the petioles to those that are subequal to or longer than the petioles. Both Oliver's illustration and his description, "pedunculis axillaribus petiolo subaequilongis," indicate that the specimens he examined had fruits with short pedicels. Henry 2981, an isotype, has leaves on which the midribs are puberulous on both surfaces and the fruiting pedicels are slightly longer than the petioles. Based on this evidence, among the host of variants we can define the typical form of *Ilex macrocarpa* as the plant with glabrous branchlets and inflorescences and fruits with pedicels subequaling or slightly exceeding the petioles. In so doing, both *Ilex henryi* Loes. and *Ilex macrocarpa* var. *brevipedunculata* S. Y. Hu are to be reduced to synonymy.

Loesener described *Ilex dubia* (G. Don) Trel. var. *hupehensis*, based on A. Henry 6214. This specimen is a fruiting branch of *Ilex macrocarpa*. Although the fruit is very young, its large size and its columnar stigma are very significant. I have dissected two fruits. Each has only 5 pyrenes. This low pyrene number is uncommon in typical *Ilex macrocarpa*. This particular plant may be a hybrid between *Ilex macrocarpa* and *Ilex macro-poda* Miq., as both species are common in Hupei Province. Because of the large leaves and fruit and the columnar stigma of the plant I think it is proper to accept it as *Ilex macrocarpa*.

6a. *Ilex macrocarpa* var. *reevesae* (S. Y. Hu), comb. nov.

*Ilex reevesae* S. Y. Hu in Jour. W. China Bord. Res. Soc. 15(B): 92. 1945, et in Ic. Pl. Omei. 2: pl. 172. 1946. *Syn. nov.*

Branchlets minutely puberulent, leaves ovate, 3-10 cm. long, 2-5.5 cm. wide, pubescent on both surfaces; inflorescences pubescent; pyrenes laterally compressed.

CHINA: Szechuan: Chengtu, *S. S. Chien* 5925 (A), 5926 (A, Sz); *W. P. Fang* 12442 (Sz); *S. Y. Hu* 535A (WCUU), 535B (WCUU).

The distribution of this variety is very localized. So far, it has been recorded only from Chengtu in the province of Szechuan. There its white and fragrant flowers appear in April. The fruit is black at maturity.

This variety is characterized by the pubescent branchlets, leaves, and inflorescences.

6b. *Ilex macrocarpa* var. *longipedunculata* S. Y. Hu in *Ic. Pl. Omei*. 2: *pl.* 171. 1946.

Branchlets glabrous; leaves ovate, ovate-elliptic, pubescent at least along the midrib above; fruiting pedicels 14–33 mm. long, often more than twice as long as the petioles; pyrenes 7–9, laterally compressed, 3-ridged and deeply canaliculate, the endocarp bony.

CHINA: Kiangsu: I-shing, *Ching & Tso* 594 (A). Chekiang: Shiao-fung-hsien, *H. H. Hu* 559 (A); Chong-hwa-hsien, *Y. L. Keng* 571 (A); Tien-mu-shan, *T. N. Liou* 311 (NY); Yi-tsun, *F. N. Meyer* 1523 (A, NY). Anhwei: Chiu-hwa-shan, *S. C. Sun* 1398 (A). Hupei (Hupei): *W. Y. Chun* 3525 (A), 2526 (A); Pa-tung-hsien, *H. C. Chow* 512 (A, NY), 665 (A, NY); Chien-shih-hsien, *H. C. Chow* 1087 (A, NY); Li-chuan, *C. T. Hwa* 97 (A); I-chang, *E. H. Wilson* 151 (A, US), 2695 (A). Hunan: Lin-ling, *Handel-Mazzetti* 423 (A). Kweichow: Tsun-yi-hsien, *Steward, Chiao & Cheo* 108 (A, NY, US); Pi-chien, Tui-po, *Y. Tsiang* 8982 (A, NY). Szechuan: *K. L. Chu* 1918 (SS). Kwangsi: Kweilin, *W. T. Tsang* 28137 (A, US), 28249 (A, US).

This variety is quite wide-spread. It appears that the shortest-pedicellate forms are found in the Upper Yangtze Provinces of Szechuan and Yunnan. The long-pedicellate forms are found in the Lower Yangtze Provinces of Kiangsi and Chekiang. A mixture of both the long- and short-pedicellate forms is found in the Central Provinces of Hupei, Hunan, and Kweichow.

This variety differs from typical *Ilex macrocarpa* in having long fruiting pedicels which are usually twice as long as the petioles.

7. *Ilex chapaensis* Merr. in *Jour. Arnold Arb.* 21: 373. July 1940; Tardieu-Blot in *Not. Syst.* XII, 15: 8. 1945, et in *Fl. Gén. Indo-Chine Suppl.* 1: 773. 1948.

*Ilex howii* Merr. & Chun ex Tanaka & Odashima in *Jour. Agr. Taiwan* 10: 372. 1938, nomen nudum; Merr. & Chun in *Sunyats.* 5: 107. August 1940; Masamune, *Fl. Kainant. (Hainan)* 174. 1943. *Syn. nov.*  
*Ilex megistocarpa* Merr. in *Jour. Arnold Arb.* 21: 373. 1940; Tardieu-Blot. in *Fl. Gén. Indo-Chine Suppl.* 1: 780. 1948. *Syn. nov.*

A deciduous tree up to 10 m. high with minutely and sparsely puberulent or glabrescent branchlets, chartaceous ovate-elliptic or oblong-elliptic crenate leaves, solitary inflorescences, large fruits with columnar stigmata and 6 oblong, ridged, and canaliculate pyrenes.

Branchlets castaneous, with numerous conspicuous lenticels; second year's growth 4 mm. in diameter, rugose with elevated orbicular lenticels,

the leaf-scars crescent-shaped, not elevated; current year's growth 2–3 mm. in diameter, very sparsely and minutely puberulent or glabrescent, slightly angular, the lenticels conspicuous; abbreviated shoots few, undeveloped, 2–3 mm. long. Leaves 10–15 mm. (rarely up to 20 mm.) apart on elongated shoots, 1 or 2 at the very tip of the abbreviated shoots; stipules deltoid, callose, persistent; petioles slender, 15–30 mm. long, one-fifth to one-third the length of the lamina, glabrous, narrowly and deeply canaliculate, the distal end slightly winged by the decurrent leaf-base; lamina chartaceous or thin-coriaceous, brunneous-olivaceous, opaque or very slightly shiny and puberulous along the midrib and veins above, glabrous beneath, rarely puberulous on both surfaces in juvenile forms, ovate-elliptic or oblong-elliptic, 5–11 cm. long, 2.5–5 cm. wide, acute, obtuse, rarely rounded at the base, acuminate or very rarely (on abbreviated shoots) obtuse or rounded at the apex; margin finely crenulate-serrulate; midrib narrowly impressed and puberulous above, glabrous and elevated beneath, the lateral nerves 8 or 9 pairs, plane or slightly impressed, often puberulous above, elevated and glabrous beneath, the reticulation of the veinlets obscure on both surfaces. Staminate inflorescences: pseudo-fasciculate, occurring at the base of the current year's growth or along the sides of the second or third year's growth, the individual branches 1–5-flowered; the pedicels of the uniflorous branches 3 mm. long with 2 basal prophylla; the peduncles of the multiflorous branches 1–2 mm. long, the pedicels 2–4 mm. long, both puberulous; flowers 6–8-merous; calyx patelliform, 4 mm. across, glabrous or minutely pubescent, shallowly 6–8-lobed, the lobes rounded, sparsely ciliate; corolla rotate, ca. 10 mm. across, the petals obovate-oblong, 4–5 mm. long, ciliate, one-eighth connate at the base; stamens equaling the petals in length, the anthers ovate-oblong, 2 mm. long; rudimentary ovary conic, the apex rostellate and parted. Pistillate flowers: solitary, axillary to the inner scales of the terminal buds of the abbreviated shoots, rarely in the leaf-axils; pedicels 6–10 mm. long, minutely puberulous, with 2 sub-basal prophylla; flowers 6- or 7-merous; calyx patelliform, 4 mm. across, the lobes ciliate; corolla suberect, 8 mm. in diameter, the petals 4 mm. long; staminodes two-thirds as long as the petals, the sterile anthers sagittate; ovary ovoid, 2 mm. long, the style evident, puberulous, the stigma columnar, 2 mm. long, conspicuously lobed. Fruit subglobose-pomiform, 14 mm. in diameter, the persistent calyx explanate, 5 mm. in diameter, orbicular in outline, ciliate, the stigma columnar, 2–3 mm. long. Pyrenes 6 or 7, oblong in outline, the ends obtuse, 13 mm. long, the dorsal side 4 mm. wide, very deeply canaliculate and 3-ridged, the sides 1- or 2-striate and sulcate, the endocarp bony.

CHINA: Kwangtung: Wung-yuen, S. K. Lau 2795 (A); Fang-cheng, W. T. Tsang 26549 (A), 26715 (A), 26814 (A); Ko-chow, Y. Tsiang 2344 (NY); Sun-yi, Y. Tsiang 2718 (A), 21166 (NY). Kwangsi: S. Nan-ning, Seh-feng-dar-shan, R. C. Ching 2766 (NY), 7966 (LU); W. Po-seh, R. C. Ching 7408 (NY). Hainan: Po-ting, F. C. How 73677 (TYPE of *Ilex howii*, A); Ting-on, S. K. Lau 28122 (A).



INDO-CHINA: Tourane, *J. & M. S. Clemens* 3389 (A), 4025 (A); Tonkin, Chapa, *A. Petelot* 2303 (TYPE of *Ilex megistocarpa*, A), 4596 (NY), 5945 (TYPE, A; ISOTYPE, NY); Hacoï, *W. T. Tsang* 27280 (A); Tien-yen, *W. T. Tsang* 30609 (A).

*Ilex chapaensis* is endemic to the subtropical or tropical forests of Hainan and the Kwangtung-Kwangsi-Indo-China border and is a shrub or small tree up to 10 m. high. Its white flowers appear in April, and the fruit turns black in November.

The large fruit and dorsally 3-ridged and canaliculate pyrenes of *Ilex chapaensis* indicate very close relationship with *Ilex macrocarpa* Oliv. The latter, however, has a glabrous style, the pyrenes are laterally compressed with the dorsal surface 1-2 mm. wide, and the pulvinate rudimentary ovary is depressed at the middle.

8. *Ilex aculeolata* Nakai in Bot. Mag. (Tokyo) 44: 12. 1930.

*Ilex rhamnifolia* Merr. in Sunyats. 1: 201. 1934; H. H. Hu & Tang in Bull. Fan. Mem. Inst. Biol. Bot. 9: 254. 1940. *Syn. nov.*

*Ilex dubia* (G. Don) Britton, Stern & Pogg. var. *hupehensis* sensu Hand.-Mzt. Symb. Sin. 7: 658. 1933, non Loes.

A deciduous shrub up to 2 m. high with both elongated and abbreviated branchlets, obovate leaves, cuneate and acuminate bases, solitary inflorescences, 4- or 5-merous flowers, pea-sized fruits and 4 deeply wrinkled, striate and sulcate stony pyrenes.

Branchlets brunneous, the lenticels on the third and fourth years' growth numerous and conspicuous; elongated shoots 3-7 cm. long, slender, pubescent, the hairs short with thick bases, sometimes branched, the terminal buds conic, sparsely pubescent; abbreviated shoots 3-5 mm. long, rugose with persistent bud-scales and leaf-scars. Leaves 5-20 mm. apart on elongate shoots, 1-3 crowded at the tips of abbreviated shoots; stipules narrowly deltoid, persistent; petioles 10-12 mm. long, one-eighth to one-third the length of the lamina, narrowly and shallowly impressed and puberulous above, glabrescent or aculeolate along the side or all over; lamina membranaceous or thinly chartaceous, dark olivaceous above, paler beneath, opaque on both surfaces, pubescent along the midrib and lateral nerves on both surfaces, glabrescent or sparsely pubescent on both surfaces, obovate, 2-5 cm. long, 1-3 cm. wide; cuneate and acuminate at the base; acute or very shortly acuminate or rarely obtuse at the apex, the acumen 2-3 mm. long; margin coarsely and argutely serrate; midrib plane or slightly impressed above, elevated beneath, pubescent on both surfaces, the lateral nerves 3 or 4 pairs, evident on both surfaces, the reticulation of the veinlets obscure. Inflorescences solitary, axillary to scales or leaves on both elongated and abbreviated shoots; flowers 4- or 5-merous. Staminate inflorescence: 1-3-flowered, the peduncles 0.5-2 mm. long, the pedicels 1.5-3 mm. long, glabrous, with 2 basal, deltoid, acute, and ciliate prophylla; calyx patelliform, 2.5 mm. across, deeply 4-lobed, the lobes suborbicular-deltoid, ciliate; corolla rotate, 7 mm. across, the petals suborbicular-ovate, 3 mm. in diameter, erose, rarely sparsely ciliate, one-third

connate at the base; stamens 4 or 5, two-thirds as long as the petals, the anthers oblong, 1.5–2 mm. long; rudimentary ovary ovoid, shortly rostellate and lobed. Pistillate inflorescences: uniflorous, the pedicels 3–4 mm. long with 2 ciliate basal prophylla; calyx and corolla as in the staminate flowers; staminodes two-thirds the length of the petals, the sterile anthers sagittate; ovary ovoid, 1.5 mm. in diameter, the stigma thickly discoid, 4-lobed.

Fruit globose, 7 mm. in diameter, the persistent calyx explanate, ciliate, subquadrangular in outline, the stigma discoid, 4-lobed. Pyrenes 4, elliptic in outline, the ends pointed, 6 mm. long, 2.5 mm. wide on the dorsal surface, deeply wrinkled, striate and sulcate, the striae branched and often reticulate, the endocarp bony.

CHINA: Kiangsi: Nan-chang, *H. H. Chung* 26 (A), 27 (A); *J. N. Hsiung* 550 (A); Yung-shing-hsien, *H. H. Hu* 776 (A); Sung-wu, *J. L. Gressitt* 156 (A); Kien-nan, *S. K. Lau* 3993 (A, US), 4797 (A); Ling-chuan, *Y. Tsiang* 9852 (NY), 9871 (NY); Houng-yang-shan, *Y. Tsang* 10563 (NY); Ping-hsiang, *T. H. Wang* (ex Handel-Mazzetti Pl. Sin. 167) (A). Hunan: Chang-ning-hsien, *C. S. Fan & Y. Y. Li* 152 (A); Sinning-hsien, *C. S. Fan & Y. Y. Li* 439 (A); Tschangscha, *Handel-Mazzetti* 2247 = 11344 (A); Da-o-ping, *Handel-Mazzetti* 2710 = 11725, (TYPE, A); Yun-schan, *T. H. Wang* (ex Handel-Mazzetti Pl. Sin. 70) (A); Yi-chang, *W. T. Tsang* 23688 (A, US). Fukien: Yen-ping, *H. H. Chung* 3266 (A). Kwangtung: Lung-t'au Mountain, *To & Tsang* (LU 12197) (US), (LU 12751) (A); Loh-chong, *C. L. Tso* 21606 (TYPE of *Ilex rhamnifolia*, A); *W. T. Tsang* 20929 (A, NY); Jen-hwa, *W. T. Tsang* 26326 (A); Yang-shan, *T. M. Tsui* 489 (A, NY, US), 649 (A, NY, US). Kwangsi: Lu-chen, *R. C. Ching* 5615 (NY, LU), 6082 (NY); Yung-hsien, *Steward & Cheo* 736 (A), 1070 (A, NY).

*Ilex aculeolata* is native to the Chinese Great Lake Provinces, Hunan and Kiangsi, and thence south to northern Kwangtung and Kwangsi. It grows in thickets or woods at an altitude of 250–600 m. The white and fragrant flowers appear in April. Its fruits become black in late September.

The membranous leaves, solitary fruits, deeply striate and sulcate pyrenes of *Ilex aculeolata* indicate close relationship between this species and *Ilex asprella* (Hook. & Arn.) Champ. ex Benth., but the latter has ovate leaves and very long (2.5–3.5 cm.) fruiting pedicels. Some specimens of this species collected from northern Kwangtung have been mistaken for *Ilex pubescens* Hook. & Arn. There is much similarity in the indumentum, leaf-form and margin, and pyrenes of these two species, but *Ilex pubescens* can easily be distinguished, since it is evergreen and has fasciculate flowers and fruits in the axil of the leaves, while *Ilex aculeolata* has solitary flowers or fruits mixed with leaves on abbreviated shoots.

#### 8a. *Ilex aculeolata* var. *kiangsiensis*, var. nov.

Arbor parva; ramulis abbreviatis, 3–15 mm. longis, rugosis; foliis obovatis, 4–9 cm. longis, 1.5–3 cm. latis, apice acutis, breviter acuminatis vel raro obtusis, basi cuneatis et acuminatis; fructibus solitariis, axillaribus, ellipsoideis, 15 mm. longis, 7–9 mm. diametro, striato-sulcatis; stigmatibus

capitato vel discoideo; pyrenis 5, 9–10 mm. longis, 2.5–3 mm. latis, dorso canaliculatis, lateralibus striato-sulcatis.

CHINA: Kiangsi: Kien-nan, S. K. Lau 4086 (TYPE, A).

This variety is localized in southern Kiangsi. So far it has been collected only from near the Kwangsi-Kwangtung border. It grows as a small tree up to 5 m. in height.

This variety differs from typical *Ilex aculeolata* in having larger (15 mm. long) fruit and leaves.

9. *Ilex macropoda* Miq. in Ann. Mus. Bot. Lugd.-Bat. 3: 105. 1867; Franch. & Sav. Enum. Pl. Jap. 1: 77. 1873; Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29: 30, 51, pl. 1, fig. 8. 1881; Hara in Bot. Mag. (Tokyo) 50: 187. 1936.

*Ilex costata* Bl. ex Miq. Cat. Mus. Bot. Lugd.-Bat. 167. 1870, nomen nudum; Maxim. l.c. 51. 1881.

*Ilex dubia* (G. Don) Trel. var. *macropoda* (Miq.) Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 487 (Monog. Aquif. 1: 487). 1901. *Syn. nov.*

*Ilex dubia* (G. Don) Trel. var. *hupehensis* Loes. l.c. 488. 1901, in part. *Syn. nov.*

*Ilex dubia* (G. Don) Britton, Stern & Pogg. var. *pseudomacropoda* Loes. in Sarg. Pl. Wils. 1: 82. 1911; Rehd. in Jour. Arnold Arb. 8: 158. 1927; Chien in Contr. Biol. Lab. Sci. Soc. China 3(1): 58. 1927.

*Ilex montana* Torr. & Gray var. *macropoda* (Miq.) Fern. in Rhodora 41: 428. 1939. *Syn. nov.*

A deciduous tree up to 13 m. high with elongated and abbreviated branchlets, conspicuous lenticels, chartaceous ovate or broad-elliptic and serrate leaves, fasciculate staminate and solitary pistillate inflorescences, globose drupes with discoid stigma, and 5 striate and sulcate bony pyrenes.

Branchlets cinereous or brunneous, glabrous; elongated ones 4–10 cm. long, 2.5–3 mm. in diameter, brunneous, longitudinally plicate, the lenticels conspicuous, elliptic, the terminal buds ovoid or broadly conic, glabrous, the inner scales ciliate; abbreviated branchlets 3–50 mm. long (tenth year's growth about 3 cm. long), glabrous, rugose with persistent bud-scales, leaf-scars and scars of the pedicels, the lenticels lacking, the terminal buds subglobose-ovoid, glabrous, with ciliate inner scales. Leaves on elongated shoots 10–25 mm. apart, 3–5 crowded at the tips of the abbreviated shoots; stipules minute, acute, deltoid, often obscure; petioles 11–20 mm. long, one-fifth to one-half the length of the lamina, those on the elongated shoots shorter, the distal fourth winged by the decurrent leaf-base, the rest narrowly and deeply canaliculate, hirsute in the groove; lamina chartaceous or membranaceous, brunneous or olivaceous-brunneous, opaque on both surfaces, sparsely hirsute especially on the veins above, glabrous, rarely puberulous beneath, ovate or broad-elliptic, 4–8 cm. long, 2.5–4.7 cm. wide, rounded at the base, but tapering sharply at the petiole, becoming decurrent, shortly deltoid-acuminate, rarely acute, at the apex, the acumen 4–7 mm. long; margin argutely serrate; midrib narrowly impressed and hirsute above, elevated and glabrous beneath, the lateral

nerves 6-8 pairs, hirsute, often slightly impressed above, prominent beneath, the reticulation of the veinlets obscure above, evident beneath. Staminate inflorescence: fasciculate, the fascicles 2-5-flowered, the individual branches uniflorous, the pedicels 4-7 mm. long, glabrous; flowers 5-merous; calyx patelliform, 2.5 mm. across, glabrous, deeply 5-lobed, the lobes ovate-deltoid, 1 mm. long and wide, acute or obtuse, often erose, ciliate; corolla rotate and reflexed, 5 mm. across, the petals ovate-oblong, 2 mm. long, 1.5 mm. wide, minutely ciliate, one-fifth connate at the base; stamens shorter than the petals, the anthers oblong, 1 mm. long; rudimentary ovary compressed, pulvinate, depressed and inconspicuously lobed at the center. Pistillate inflorescence: solitary, axillary to the scales or rarely to the leaves of the abbreviated shoots, not uncommonly axillary to the lower leaves of the elongated shoots; pedicels 6-7 mm. long, glabrous; flowers 5- or 6-merous; calyx and corolla as in the staminate flowers; staminodes three-fourths the length of the petals, the sterile anthers cordate; ovary ovoid, 1.75 mm. long, 1.5 mm. wide, the stigma thick-discoid. Fruit globose, 5 mm. in diameter, the persistent calyx explanate, 2.5 mm. across, stellate in outline, the lobes 5 or 6, acute, deltoid, ciliate, the stigma discoid, convex, 5- or 6-lobed. Pyrenes 5, oblong in outline, the ends obtuse, 4-4.5 mm. long, 2 mm. wide, longitudinally and reticulately striate and sulcate, the endocarp bony.

CHINA: Chekiang: Tien-tai-shan, R. C. Ching 1403 (A); Tien-mu-shan, T. N. Liu 257 (NY); Chekiang Univ. s.n. (staminate flower, LU; fruit, LU). Anhwei: Wang-shan, W. C. Cheng 4115 (W); R. C. Ching 3020 (A), 3048 (A, LU); K. Ling (ex NU Herb. no. 7772) (A); Wu-Yuan, R. C. Ching 3241 (A); Chiu-hwa-shan, S. C. Sun 1445 (A, NY). Kiangsi: Lu-shan, H. H. Hu 2354 (LU); Y. Tsiang 10756 (NY). Hupei (Hupeh): A. Henry 6107 (ISOTYPE of *Ilex dubia* var. *hupehensis*, A, G, NY); western Hupeh, E. H. Wilson 2695A (K); Hsing-shan-hsien, E. H. Wilson 3090 (TYPE of *Ilex dubia* var. *pseudomacropoda*, A).

JAPAN: Buerger (ISOTYPE, A); J. G. Jack in 1905 (Aug. 12, A, G; Sept. 6, A; Oct. 26, A, G); Maximowicz in 1862 (NY), in 1863 (G, NY); ex Herb. K. Miyabe (A); K. Sakurai in 1904 (A); K. Shiota 67 (A), 3456 (A), 7207 (A); Siebold (A, NY); C. S. Sargent in 1892 (Sept. 2, 24, A; Oct. 24, G, A); Tschonoski in 1864 (G, NY); J. H. Veitch (A); K. Uno 21884 (A, NY); K. Watanabe in 1888 (G); E. H. Wilson in 1914 (A).

KOREA: U. Faurie 1634 (A), 1635 (B), 5522 (A); Taquet 629 (A), 1348 (A), 2716 (A), 3183 (A); E. H. Wilson 9503 (A).

CULTIVATED: I have seen two sterile specimens cultivated in the Arnold Arboretum.

*Ilex macropoda* was first described from Japan. The species, however, is very wide-spread and a fairly common tree in the woods or forests of the Lower Yangtze Provinces. The flowers appear in May, and the fruit reddens in September.

*Ilex macropoda* is closely related to an American deciduous species, *Ilex montana* Torr. & Gray, which differs in having very short-pedicellate fruits (shorter than the diameter of the mature fruit) and a styliferous ovary.



Upon the basis of a specimen collected by *Buerger*, Miquel in 1867 described *Ilex macropoda* as a long-petiolate species with broad-ovate glabrous leaves. Loesener in 1901 treated it as a variety of the American species, *Ilex dubia* (G. Don) B.S.P. But this type of Don's species has solitary, subumbelliform inflorescences. It is not the same as *Ilex macropoda* Miq. and, in fact, is not closely related to it.

Prof. Fernald (*Rhodora* 41: 428. 1939) treated *Ilex macropoda* Miq. as a variety of another American species, *Ilex montana* Torr. & Gray. With this also I cannot agree. The Asiatic species is closely related to *Ilex montana*, but geographically and morphologically, since it has distinct specific characters, it should be retained as a species. The following comparison shows these differences.

*Ilex montana* has (1) an ovary which is styliferous, the styles measuring 1–2 mm. in length; (2) fruiting pedicels 2–4 mm. long and shorter than the diameter of the mature fruit; (3) rudimentary ovary in the staminate flowers pulvinate with the center rostellate; and (4) pyrenes 6 mm. long, deeply striate and sulcate. On the other hand, *Ilex macropoda* has (1) the stigma sessile and discoid; (2) the fruiting pedicels 6–7 mm. long and longer than the diameter of the mature fruit; (3) the rudimentary ovary in the staminate flowers also pulvinate but with a depressed center; and (4) the pyrenes smaller (ca. 4.5 mm. long) and less deeply striate and sulcate.

Loesener in 1913 published *Ilex dubia* var. *pseudomacropoda* based on a staminate flower, *Wilson* 3090. He distinguished this variety from typical *Ilex macropoda* as follows: "Ramulis abbreviatis crassis usque 4.5 cm. longis, foliis subtus glabris." These two characters, the length of the abbreviated shoot and the indumentum of the leaf surface, vary much in this group of *Ilex*; indeed, the characters suggested by Loesener for his variety are found even on *Buerger*'s specimen, the collection on which Miquel's species was based.

10. *Ilex tsoii* Merr. & Chun in *Sunyats.* 1: 66. 1930; Hu & Chun,  *Ic. Pl. Sin.* 4: *pl.* 18. 1935.

A deciduous shrub or small tree up to 4 m. high with elongated and abbreviated branchlets, chartaceous, pubescent, ovate, or ovate-elliptic serrate leaves, very shortly pedicellate fruits, and 5 reticulately striate-sulcate bony pyrenes.

Branchlets castaneous or atro-griseous, the annual growth of the elongated shoots 2.5–6 cm. long, 2–3 mm. in diameter, castaneous, or ochraceous, the lenticels conspicuous, elliptic, the terminal buds globose ovoid, glabrous, with ovate, acute, or cuspidate, densely long-ciliate scales; abbreviated shoots up to 3.5 cm. long, rugose with persistent bud-scales and scars, glabrous. Leaves 15–20 mm. apart on elongate shoots, 1–3 crowded at the ends of the abbreviated shoots; stipules broadly and shortly deltoid, callose, persistent; petioles 6–10 mm. long, one-sixteenth to one-ninth the length of the lamina, and narrowly winged by its decurrent base, glabrous, canaliculate above; lamina chartaceous, olivaceous, opaque,

prominently marked with small areoles, glabrescent or pubescent, especially along the veins of both surfaces, ovate or ovate-elliptic, 5–10 cm. long, 3–5 cm. wide, rounded at the base, acute at the apex, the acumen 7–15 mm. long, serrate and cuspidate; margin finely and argutely serrate; midrib deeply and narrowly impressed and puberulent above, elevated and hirsute, glabrescent in age beneath, the lateral nerves 9 or 10 pairs, slightly elevated, prominent and pubescent on both surfaces, the veinlets densely reticulate, forming distinct minute areoles on both surfaces. Staminate inflorescences: fasciculate, the fascicles 1–3-flowered, the individual branches uniflorous; pedicels 3–4 mm. long, glabrous; flowers 6-merous; calyx patelliform, 4 mm. across, deeply 6-lobed, the lobes unequal in size, deltoid or ovate, 1 mm. long, 1 mm. wide, acute, rarely rounded, ciliate; corolla rotate, 6–7 mm. across, the petals oblong, 2 mm. long, very minutely ciliate, one-fourth connate at the base; stamens shorter than the petals, the anthers oblong; rudimentary ovary pulvinate, the center plane, inconspicuously lobed. Pistillate inflorescences: solitary, axillary to scales or rarely to leaves on the abbreviated or elongated shoots, the scales ovate, deltoid, acute or cuspidate, ciliate; pedicels 1–3 mm. long, glabrous; flowers 5–7-merous; the calyx and corolla as in the staminate flowers; staminode very small, one-fifth the length of the petals, the sterile anthers cordate; ovary ovoid, 2 mm. in diameter, the stigma thickly discoid, convex. Fruit globose, 6–8 mm. in diameter, the persistent calyx explanate, stellate in outline, the stigma thickly discoid or capitate, prominent. Pyrenes 6, oblong in outline, the ends obtuse, 5 mm. long, 2.5 mm. wide on the back, deeply ridged and sulcate, the striae reticulate, the endocarp bony.

CHINA: Chekiang: Tih-tai-shan, *R. C. Ching* 1522 (A, US); between Ping-yung and Tai-suan, *R. C. Ching* 2113 (A, LU, US). Kweichow: Fan-ching-shan, *Steward, Chiao & Cheo* 405 (A, NY, US). Kwangtung: Huang-tung, *S. S. Sun* 9158 (NY); Jen-hwa, *W. T. Tsang* 26266 (A), 26386 (A), 26391 (material for the description of pistillate flower, A), 26396 (A); Ho-yuen, *W. T. Tsang* 28850 (A); Lok-chong, *C. L. Tso* 20778 (TYPE, NY; photo, A). Kwangsi: Shuen-yuen, *S. C. Chung* (*T. S. Tsoong*) 81544 (A); Chuen-yuen *S. C. Chung* (*T. S. Tsoong*) 82014 (A); Tsu-yuen, *Z. S. Chung* (*Tsoong*) 83507 (A).

*Ilex tsoii* was first discovered at Lok-chang on the northern Kwangtung border. Additional material indicates that it is a common species in warm-temperate South and East China, where it grows as a large shrub in thickets or as a tree in the woods. The flowers appear in May, and by July the fruits have become dark purple.

In the size of the leaves, the length of the pedicels, and the sculpture of the pyrenes *Ilex tsoii* is almost identical with *Ilex montana* Torr. & Gray, a native of North America. Besides occurring on different continents, there are certain technical characters that serve to distinguish these two species. *Ilex montana* has broad-elliptic or obovate leaves, acute or acuminate at the base, 2–5-flowered individual branches of the staminate fascicles, rostellate rudimentary ovaries, styliferous ovaries and fruits, and larger

(6 mm. long, 3 mm. wide) pyrenes. Furthermore, the characteristic minute but distinct areoles on the leaf-surfaces of *Ilex tsoii* are lacking in the leaves of *Ilex montana*.

*Ilex tsoii* differs from *Ilex macropoda* Miq. in having very short fruiting pedicels (1–2 mm. long). From *Ilex fragilis* Hook. f. it differs in having only 5 or rarely 6 pyrenes which are not only larger, but are deeply and reticulately striate and sulcate.

#### B. SUBGENUS EUILEX LOESENER

*Ilex* subgenus *Euilex* Loes. in Verh. Bot. Ver. Brand. 33: 25, 26. 1891, in Engl. & Prantl, Nat. Pflanzenfam. Nachtr. 218. 1897, et in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 94 (Monog. Aquifol. 1: 94). 1901.

*Ilex* subgenus *Aquifolium* (Gray) Rehder, Man. Cult. Trees Shrubs 541. 1927, et Bibliog. Cult. Trees Shrubs 399. 1949.

*Ilex* §1. *Aquifolium* Gray, Man. Bot. N. U. S. 276. 1848.

*Ilex* sect. *Ilex* Maxim. in Mém. Acad. Sci. St. Pétersb. VII. 29(3): 26. 1881.

Trees or shrubs with branchlets all elongated, the lenticels usually lacking on the current, second or even the third year's growth; leaves evergreen, thick-coriaceous, coriaceous or rarely chartaceous; inflorescences solitary or fasciculate.

#### KEY TO THE SECTIONS

- A. Pistillate and staminate inflorescences both solitary, axillary, on the current year's growth; pyrenes unicanaliculate or 3-striate and 2-sulcate on the dorsal surfaces; endocarp coriaceous or sublignescens. . . . .Sect. V. *Lioprinus*.
- AA. Pistillate flowers solitary, axillary on the current year's growth (except in some *Ilex triflora* Blume), the staminate flowers fasciculate on the second year's growth or rarely solitary on the current year's growth; pyrenes smooth, or striate and esulcate with insculpt striae, or slightly roughened; endocarp coriaceous. . . . .Sect. VI. *Paltoria*.
- AAA. Pistillate and staminate inflorescences both fasciculate, axillary, on the second year's or even older growth; pyrenes rugose and pitted or striate with elevated striae; endocarp coriaceous, woody or stony.
  - B. Pyrenes 4, rarely less; the endocarp woody or stony; individual branches of the pistillate fascicles uniflorous. . . . .Sect. VII. *Aquifolium*.
  - BB. Pyrenes 6 or 7, rarely less or more, the endocarp coriaceous or sublignescens; individual branches of the pistillate fascicles cymose, umbelliform, or uniflorous.
    - C. Individual branches of the staminate and the pistillate fascicles trichotomous compound cymes or subumbels, each with more than 10 flowers; leaves 10–20 cm. long, 4–7 cm. wide. . . . .Sect. VIII. *Lauroilex*.
    - CC. Individual branches of the fascicles 1-, 3-, or sometimes 5-flowered; leaves rarely up to 10 cm. long, 3.5 cm. wide. . . . .Sect. IX. *Pseudoaquifolium*.

## SECTION V. LIOPRINUS (LOES.), STAT. NOV.

*Ilex* subgen. *Euilex* Loes. ser. *Lioprinus* Loes. in Verhandl. Bot. Ver. Prov. Brandenb. 33: 26, 27. 1891, in Engler & Prantl, Nat. Pflanzenfam. Nachtr. 218. 1897, et in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 95 (Monog. Aquif. 1: 95). 1901.

Evergreen trees or shrubs with solitary inflorescences in the axils of the leaves or scales on the current year's growth.

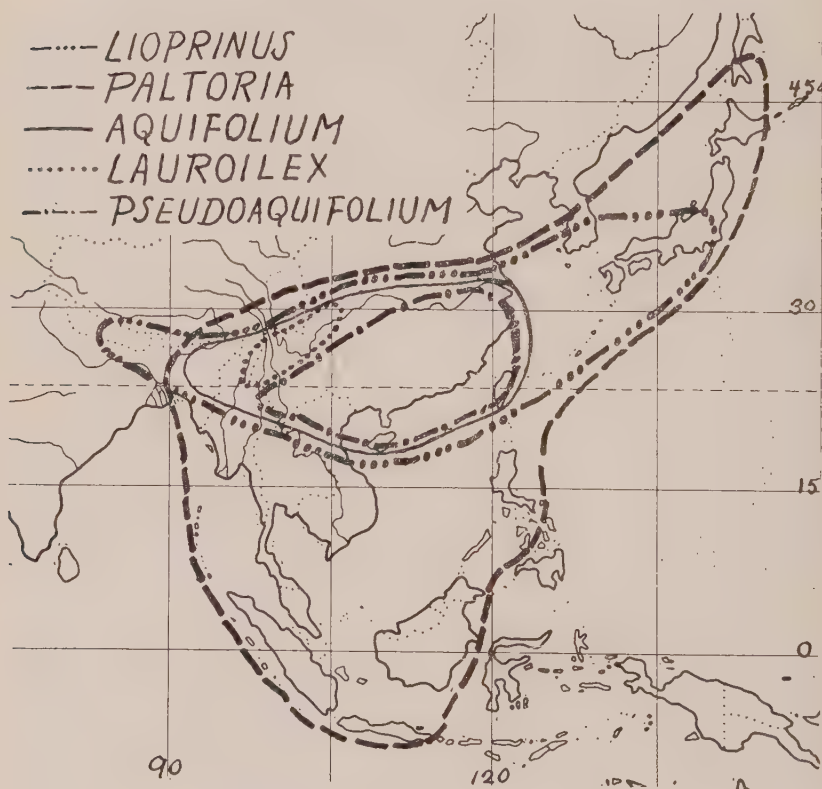


FIG. 5. Geographic distribution of the Eastern Asiatic representatives of the five sections of the subgenus *Euilex*.

## KEY TO THE SERIES

- A. Pyrenes unicanaliculate on the dorsal surfaces; inflorescences cymose; leaves usually crenate, serrate, rarely entire.....Series 1. *Chinenses*.  
 AA. Pyrenes 3-striate and 2-sulcate on the dorsal surfaces; inflorescences usually umbelliform, rarely cymose; leaves entire.....  
 .....Series 2. *Umbelliformes*.



## SERIES 1. CHINENSES, SER. NOV.

Arbor vel frutex; foliis chartaceis vel coriaceis, brunneis vel atrobrunneis; stipulis nullis vel minutis; inflorescentiis cymosis vel subumbelliformibus, solitariis, axillaribus; floribus 4-6-meris; fructibus ellipsoideis raro globosis; pyrenis 4-6, laevibus, dorso longitudinaliter profunde unicanaliculatis, raro impressis; endocarpio coriaceo vel sublignescente.

## KEY TO THE SPECIES

- A. Leaves entire, thickly coriaceous (except in *I. lonicerifolia* of Taiwan).
- B. Infructescence a compound cyme, the secondary axis well developed; leaves large, 13-14 cm. long and 4-8 cm. wide. (Kwangtung-Kwangsi).....11. *I. maclurei*.
- BB. Infructescence a simple cyme, the secondary axis not developed; leaves less than 11-12 cm. long.
  - C. Fruit solitary, 10-12 mm. in diameter; peduncles and pedicels together less than 4 mm. long, shorter than the diameter of the fruit. (Hainan).....12. *I. lancilimba*.
  - CC. Fruit in simple loose cymes or subcapitate umbels, less than 10 mm. in diameter; peduncles longer than the diameter of the fruit.
    - D. Infructescence a subcapitate umbel; fruiting pedicels 0.5-2 mm. long, much shorter than the peduncles. (Taiwan).....13. *I. tugitakayamensis*.
    - DD. Infructescence a loose umbel or cyme; fruiting pedicels equaling or longer than the peduncles.
      - E. Plants densely pubescent; petioles 4-10 mm. long, one-seventeenth to one-eighth the length of the lamina.
        - F. Leaves coriaceous, less than 6 cm. long, 2.5 cm. wide. (S. China).....14. *I. dasyphylla*.
        - FF. Leaves thinly coriaceous or chartaceous, over 8 cm. long, 3 cm. wide. (Taiwan).....15. *I. lonicerifolia*.
      - EE. Plants glabrous; petioles 10-25 mm. long, one-fifth to one-fourth the length of the lamina.
        - F. Leaves ovate; cymes loose, the peduncles 2-3 cm. long, the pedicels 1-1.5 cm. long. (Hainan, Kwangtung).....16. *I. sterrophylla*.
        - FF. Leaves elliptic; cymes compact, the peduncles less than 2 cm. long, the pedicels even shorter. (East, Central and West China)....17. *I. editicostata*.
- AA. Leaves crenate or serrate (except in *I. manneiensis*), subcoriaceous, chartaceous or membranaceous (except in *I. suaveolens*).
  - B. Leaves ovate, less than 5 cm. long. (Yunnan)....18. *I. ferruginea*.
  - BB. Leaves usually elliptic, 8-15 cm. long.
    - C. Leaves coriaceous; inflorescences subumbelliform, the peduncles 15-33 mm. long, usually longer than the petioles. (Central China).....19. *I. suaveolens*.
    - CC. Leaves subcoriaceous or chartaceous; inflorescences cymose, the peduncles less than 15 mm. long, usually shorter than the petioles.

- D. Leaves entire, the midrib ferruginously and densely pubescent beneath; pedicels very short (1-2 mm. long), shorter than the peduncles. (Yunnan).....20. *I. mannei*ensis.
- DD. Leaves crenulate, the midrib glabrous or puberulent; pedicels 4-5 mm. long, usually longer than peduncles.
- E. Branchlets glabrous; leaves rarely 10 cm. long, glabrous; fruits ellipsoid; pyrenes narrowly canaliculate. (East, Central, South, and West China, Japan, much cultivated).....21. *I. chinensis*.
- EE. Branchlets puberulous; leaves over 12 cm. long, usually puberulous; fruits subglobose; pyrenes broadly U-shaped or triangular in cross-section.
- F. Cymes compound, the secondary axis well developed; peduncles 5-12 mm. long, longer than the pedicels; pyrenes broadly U-shaped. (South China).....22. *I. kwangtungensis*.
- FF. Cymes simple, secondary axis lacking; peduncles 2-3 mm. long, shorter than the pedicels; pyrenes triangular in cross-section. (Yunnan).....23. *I. atrata*.

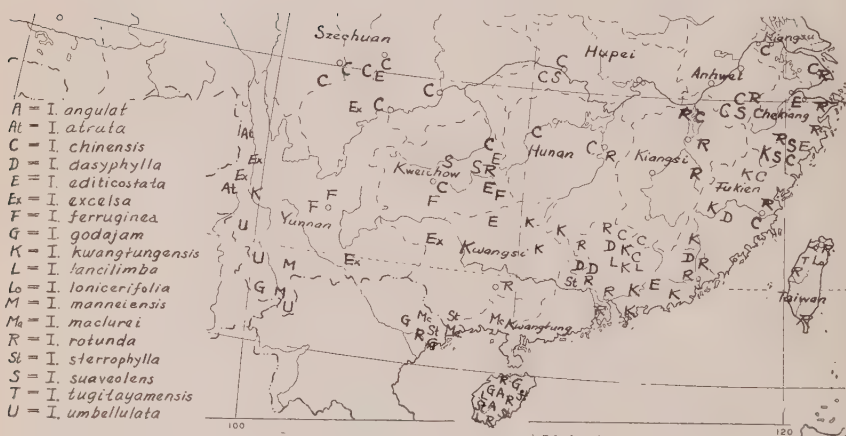


FIG. 6. Geographic distribution of the species of the section *Lioprinus* in China.

# 11. *Ilex maclurei* Merr. in Lingnan Sci. Jour. 13: 35. 1934.

A small tree or shrub about 3-4 m. high with large coriaceous entire glossy oblong leaves, several times di- or trichotomous infructescences, globose red drupes, and 4 pyrenes unicanaliculate on the back.

Branchlets stout, glabrous; second year's growth 5 mm. long, striate when dry, castaneous, the lenticels sparse, minute, elliptic, inconspicuous, the leaf-scars obovate or deltoid, very slightly elevated; current year's growth angular, 4-5 mm. thick, striate, sulcate, castaneous. Leaves occurring also on second year's growth, 4-20 mm. apart; stipules lacking;

petioles 15–20 mm. long, one-ninth to one-sixth the length of the lamina, robust, subcylindric, canaliculate above, plicate-rugose beneath, glabrous; lamina thick-coriaceous, olivaceous-brunneous, shiny above, opaque beneath, oblong or oblong-elliptic, 9–19 cm. long, 3.5–8.5 cm. wide; base obtuse or rounded; apex very obtuse, rounded, or rarely shortly and broadly acuminate; margin entire, slightly recurved, midrib plane above, elevated beneath, the lateral nerves in 10–12 pairs, obscure above, evident beneath, the reticulation of the veinlets obscure on both surfaces. Flowers not seen. Inflorescence twice or thrice dichotomous, with 7–9 fruits; peduncles glabrescent or glabrous, 8–17 mm. long, compressed, enlarged at the distal end, the secondary axes 2–8 mm. long, the bracts deltoid to lanceolate, entire, glabrous, the pedicels 3–6 mm. long with 2 basal prophylla; fruiting calyx 4 mm. across, 4- or 5-lobed, the lobes rounded, very shortly ciliate. Fruit globose, 6–7 mm. in diameter, when dry black, shiny, plicate, the stigma mammiform. Pyrenes 4, oblong in outline, U-shape in cross-section, 4.5 mm. long, 3 mm. wide at the back, deeply unicanaliculate on the back, the endocarp thickly coriaceous.

CHINA: Kwangtung: Lim-kong, *F. A. McClure* 643 (= LU 19822) (TYPE, NY; ISOTYPE, LU; photo, A).

INDO-CHINA: Tonkin: *W. T. Tsang* 27164 (A), 30335 (A).

In its oblong leaves and 2 or 3 times di- or trichotomous inflorescences *Ilex maclurei* resembles *Ilex thorelii* Pierre, but the latter has thinner leaves and 9–12-celled ovaries. The Tsang Indo-Chinese collections come from immediately south of the Chinese border.

12. *Ilex lancilimba* Merr. in *Lingnan Sci. Jour.* 7: 312. 1929; Tanaka & Odashima in *Jour. Soc. Trop. Agr.* 10: 372. 1938; Masamune, *Fl. Kainant.* [Hainan] 174. 1943.

An evergreen tree 10 m. high with yellowish pubescent branchlets and inflorescences, lanceolate entire leaves, short fruiting pedicels, large, usually solitary fruits, and 4 unicanaliculate pyrenes.

Trunk 20 cm. in diameter; branchlets straight, the third year's growth cinereous-rufous, 6 mm. in diameter, plicate and rugose, the large semi-orbicular leaf-scars united with the scars of the peduncles immediately above them, the lenticels inconspicuous, cinereous-rufous; current year's growth nigrescent, plicate, angular, 1 mm. thick, minutely yellowish pubescent. Leaves crowded on the current year's growth, 3–10 mm. apart; stipules lacking; petioles compressed, 15–25 mm. long, 5 mm. wide, one-sixth the length of the lamina, sparsely puberulent, the upper half slightly winged by the decurrent leaf-base; lamina glabrous, thick-coriaceous, cinnamomeous or fumous, slightly shiny above, opaque beneath, lanceolate, 8–14 cm. long, 2–4 cm. wide; base cuneate or obtuse; apex acute or shortly acuminate, the acumen 5 mm. long; margin entire; midrib plane, slightly elevated and puberulent above, elevated and when young sparsely hirtulose beneath, the lateral nerves in 10–14 pairs, rather obscure on both surfaces, the reticulation of the veinlets usually obscure. Inflorescences cymose, tomentose, solitary, axillary to the basal scales or to the

leaves of the current year's growth; flowers 4-merous. Staminate inflorescences: cymes 3 times di- or trichotomous, the peduncles 5–14 mm. long, the secondary axis often well developed, the pedicels 1.5–2 mm. long; calyx patelliform, 3 mm. across, 4-lobed, the lobes broadly deltoid, 1 mm. long, 2 mm. wide at the base, the apex rounded or obtuse; corolla pink-purple, rotate, 7 mm. across, the petals ovate-oblong, 2.5–3 mm. long, one-third connate at the base; stamens shorter than the petals, the anthers oblong, 1.5 mm. long; rudimentary ovary minute, conic. Pistillate inflorescences: cymes 3-flowered, the peduncles 2 mm. long, the pedicels 1–2 mm. long; flowers greenish white, 4- or 5-merous; calyx and corolla as in the staminate flowers; staminodes one-half the length of the petals, the sterile anthers cordate; ovary large, ovoid, 2 mm. in diameter, the stigma thickly discoid, 4-lobed. Fruit globose, usually solitary, very large for the genus, 10–12 mm. in diameter; fruiting pedicels 4–6 mm. long, 2–2.5 mm. thick, yellowish pubescent, the persistent calyx explanate, quadrangular in outline; the stigma discoid, 4-lobed. Pyrenes 4, smooth, oblong in outline, dorsally broadly canaliculate, in cross-section widely U-shaped; the endocarp sublignescent.

CHINA: Kwangtung: Ying-tak, *McClure 2680* (= CCC 14541) (A, isotype, photo); Sin-fung, *Y. W. Taam 541* (A). Hainan: Fan-ya, *N. K. Chun & C. L. Tso 44096* (A, NY, US), *44125* (A, NY); Mo-san-leng, *N. K. Chun 44297* (A, NY), *44301* (A, NY, US); Yai-chow, *F. C. How 70136* (A, NY); Po-ting, *F. C. How 73681* (A); Sak-sa, *S. K. Lau 25947* (A), *26582* (A), *26588* (A); Lok-tung, *S. K. Lau 27303* (A); *L. Tang, 455* (A); *C. Wang 35115* (A, NY).

*Ilex lancilimba* is a forest tree in the tropical regions of Kwangtung and Hainan, where it grows up to an altitude of 1130 m. Its pink-purple staminate and greenish-white pistillate flowers appear in March, and by November the red fruits are mature.

In its large coriaceous entire leaves this species resembles the Taiwan *Ilex tugitakayamensis* Sasaki, but the latter has subcapitate-umbelliform infructescences, smaller fruits, and smooth pyrenes slightly impressed on the dorsal surfaces.

13. *Ilex tugitakayamensis* Sasaki in *Trans. Nat. Hist. Soc. Form.* 21: 153, fig. 3. 1931; Kanehira, *Form. Trees* 383. 1936.

An evergreen tree with robust branchlets, large coriaceous elliptic entire leaves, unbelliform infructescences, very shortly pedicellate fruits, and 5 or 6 pyrenes with the dorsal surfaces flat or slightly concave.

Branchlets glabrous, when dry brunneous; rugose with elevated leaf-scars, annual growth very slight, only 4–5 mm. in the one specimen seen; third year's growth 5.5 mm. in diameter, the lenticels lacking, the leaf-scars deltoid; second and current year's growth 4–5 mm. in diameter, angular and plicate-rugose. Leaves rather crowded; stipules obsolete; petioles 2–2.5 mm. long, one-sixth to one-fifth the length of the lamina, shallowly and broadly canaliculate above, glabrous; lamina thickly coriaceous, ochraceous-brunneous, opaque on both surfaces, glabrous, elliptic or



oblong-elliptic, 10–14 cm. long, 3–5 cm. wide; base acute; apex shortly acuminate, the acumen 5–10 mm. long, the very tip obtuse; midrib elevated on both surfaces, glabrous, the lateral nerves in 12–14 pairs, evident on both surfaces, branching and anastomosing near the margin, the reticulation of the veinlets rather obscure on both surfaces. Infructescences subumbelliform, puberulent, solitary, axillary, on current year's growth only; peduncles 8–9 mm. long, flattened, slightly enlarged at the distal end, umbels 5–7-flowered; bracts linear, 2–3 mm. long, puberulous; pedicels very short, 0.5–1 mm. long; flowers 5- or 6-merous; persistent calyx subexplanate, densely pubescent, 4 mm. in diameter, shallowly 5-lobed, the lobes deltoid, obtuse, pubescent and ciliate. Fruits ellipsoid-globose 5–7 mm. long, 5 mm. across, the stigma navel-like, inconspicuously 5- or 6-lobed. Pyrenes 4–6, usually elliptic in outline, trigonous in cross-section, 4 mm. long, 2 mm. wide on the back, the back flattened or slightly concave, the endocarp smooth, coriaceous.

CHINA: Taiwan: Mt. Tugitaka, *Y. Simada* 2538 (TU, TYPE).

*Ilex tugitakayamensis* Sasaki is known from a single collection. Through the courtesy of Dr. H. L. Li, Curator of the Herbarium, National Taiwan University, I have been able to study the type specimen.

Its large elliptic entire leaves, the flattened peduncles, and the short pedicels relate it to *Ilex lancilimba* Merr., but that species differs in having (very) short-pedicellate and very large solitary fruits 10–12 mm. in diameter and broadly canaliculate pyrenes. Though apparently rare, *Ilex tugitakayamensis* seems to be a valid species.

14. *Ilex dasyphylla* Merr. in Lingnan Sci. Jour. 7: 311. 1931; Chun in Sunyats. 2: 68. 1934.

*Ilex faveo-mollissima* Metcalf in Lingnan Sci. Jour. 11: 14. 1932.

An evergreen tree up to 9 m. high, with ferrugineous-velutinous branchlets, leaves, and inflorescences, entire leaves, simple loose axillary cymes and deeply unicanaliculate pyrenes.

Branchlets zigzag, subterete; fourth year's growth 3.5–4 mm. in diameter, cinereous, pubescent, the lenticels numerous, inconspicuous, the leaf-scars small, triangular or semi-orbicular, hardly elevated; third and second years' growth 2.5–3 mm. in diameter, densely villose, the lenticels lacking; current year's growth 1.5–2 mm. thick, thickly ferrugineous-velutinous. Leaves occurring also on second year's growth, 2–8 mm. apart; stipules subulate, covered by the pubescence; petioles short, 4–5 mm. long, one-seventeenth to one-eighth the length of the lamina, very densely velutinous; lamina coriaceous, velutinous on both surfaces, brunneous, ovate, ovate-elliptic or ovate-lanceolate, 3–9 cm. long, 1.3–2.4 cm. wide; base obtuse, rarely rounded; apex acuminate, rarely acute, the acumen 3–12 mm. long; midrib impressed above, elevated beneath, the lateral nerves obscure. Inflorescences cymose, solitary, axillary on current year's growth, densely ferrugineous-villose; flowers 4- or 5-merous. Staminate inflorescences: cymes 3–5-flowered pseudumbelliform; peduncles slender, weak, 4–5 mm. long; bracts to individual flowers deltoid, buried in and

covered with hairs; pedicels 2 mm. long with minute basal prophylla; calyx patelliform, densely velutinous and ciliate, 3 mm. across, the lobes deltoid or rounded; corolla rotate, the petals ovate-oblong, 3 mm. long, 2.5 mm. wide, reflexed at anthesis, one-fifth connate at the base; stamens equaling the petals in length; the anthers oblong, 1.5 mm. long; rudimentary ovary pyramidal, truncate at the apex. Pistillate inflorescences: cymes 1-3-flowered; peduncles 5-8 mm. long, the bracts linear-lanceolate, 1.5 mm. long; pedicels 3-8 mm. long, with minute basal prophylla; calyx and corolla as in the staminate flowers; staminodes one-half the length of the petals, the sterile anthers sagittate; ovary conic, 2 mm. wide at the base, the stigma mammiform; style rather prominent, 4-angled. Fruit globose, 5-6 mm. in diameter, red, when dry brownish red, smooth, shiny; the persistent calyx explanate, 4-5 mm. in diameter, the stigma thickly discoid. Pyrenes 4 or 5, short and plump, 4 mm. long, 2.5 mm. wide and unicanalicate on the back, the endocarp coriaceous.

CHINA: Fukien: *Dunn* ex Hongkong Herb. no. 2464 (ISOTYPE of *Ilex flaveo-mollissima*, A). Kwangtung: Ying-tak, (CCC) 14775 (ISOTYPE, photo, A); Wung-yuen, S. K. Lau 2796 (A); Sin-fung, W. Y. Taam, 703 (A), 839 (A); Ta-pu, W. T. Tsang 21625 (A, NY). Kwangsi: Wai-tsap, W. T. Tsang 22725 (A).

This is a shrub or small tree up to 9 m. high. It flowers in May. The staminate flowers are red and odorless (ex Taam). The fruit turns red in September.

The species is a very distinct one. There is no other Chinese *Ilex* that has such a dense ferrugineous indument. Its unicanalicate pyrenes and loose infructescences simulate those of *Ilex chinensis* Sims, which differs in having crenate-serrate glabrous leaves.

15. *Ilex lonicerifolia* Hayata, Icon. Pl. Form. 3: 54, pl. 8, 1913; Kanehira, Form. Trees 376, fig. 332. 1936.

A small evergreen tree with ferrugineous pubescence, subcoriaceous oblong-elliptic or rarely ovate-elliptic entire leaves, solitary subumbelliform axillary inflorescences, small ovoid-subglobose fruits and 5 or 6 elliptic unicanalicate pyrenes, trigonous in cross-section.

Branchlets subterete, second year's growth 3 mm. in diameter, densely pubescent, sparsely rimulose, the lenticels very few, the leaf-scars semi-orbicular-deltoid; current year's growth 2 mm. in diameter, when dry castaneous, longitudinally sulcate, densely pubescent, the terminal buds conic, densely ferrugineously pubescent. Leaves occurring also on the second year's growth, 10-15 mm. apart; stipules minute, deltoid, often obsolete; petioles 4-8 mm. long, one-fifteenth to one-twelfth the length of the lamina, shallowly canaliculate above, pubescent or sparsely hirsute; lamina subcoriaceous, castaneous above, brunneous beneath, opaque on both surfaces, oblong, oblong-elliptic, rarely ovate-elliptic, (4.5-) 8-11 (-12) cm. long, 2-4.5 cm. wide; base obtuse, rarely rounded; apex short-acuminate, rarely acute, sometimes rounded, the acumen 3-7 mm. long, the very tip acute or mucronate; margin entire, recurved; midrib plane or

slightly impressed and hirsute above, elevated beneath, the lateral nerves in 10–12 pairs, prominent on both surfaces, anastomosing near the margin, the reticulation of the veinlets evident above, obscure beneath. Inflorescences subumbelliform, axillary, found only on the current year's growth, often behind an axillary bud, hirsute, 3–11-flowered. Pistillate inflorescences: peduncles 1–2 cm. long; bracteoles bristle-like, 1 mm. long, pubescent, borne 1.5 mm. below the umbel, the pedicels 4–6 mm. long, with 0–2 deltoid callose basal prophylla; flowers 5- or 6-merous; calyx patelliform, 3.5 mm. across, pubescent, the lobes deltoid, obtuse, ciliate; corolla rotate, 7 mm. across, the petals ovate-oblong, 2.5–3 mm. long, eciliate, one-sixth connate at the base; staminodes three-fourths the length of the petals, the sterile anthers sagittate; ovary ovoid, 2 mm. long, 1.5 mm. wide at the base, glabrous; the stigma thickly discoid or mammi-form, convex, 5- or 6-lobed. Staminate flowers unknown. Fruit ovoid-globose, 5–7 mm. in diameter, the persistent calyx subexplanate-patelliform, 4 mm. across, the stigma mammiiform. Pyrenes 5 or 6, elliptic in outline, trigonous in cross-section, concave on the dorsal surface, 4–4.5 mm. long, back 2 mm. wide, the endocarp smooth, coriaceous.

FORMOSA: Lake Candidus, *J. L. Gressitt* 230 (A); *E. H. Wilson* 9977 (A); Taichu, Lake Jilugetutan, *Y. Kudo* in 1929 (A); Nokozen, *E. Matuda* in 1919 (TU); Sekiin, *Kudo & Sasaki* 15245 (TU); Taihokusyu, *T. Suzuki* 17025 (TU); without precise locality, *Kudo & Yamamoto* in 1930 (TU).

*T. Suzuki's* specimen has much smaller leaves than the other specimens examined. Its fruits are solitary. Judging from the length of the annual growth of the branchlets (which is very short) and the mosses thereon, the plant may have been a low one from deep forests. *E. Matuda's* specimen is less extreme and transitional to the typical forms of the species in size of leaves and in inflorescences. It bears both large and small leaves as well as both solitary and clustered fruits. The species is a variable one in these characters.

The subcoriaceous leaves, subumbelliform infructescences, and canaliculate pyrenes of *Ilex lonicerifolia* suggest close relationship between this species and *Ilex chinensis* Sims, which differs in having crenate leaves, larger fruits, and only 4 pyrenes.

15a. *Ilex lonicerifolia* var. *hakkuensis* (Yamamoto), comb. nov.

*Ilex hakkuensis* Yamamoto Suppl. Ic. Pl. Form. 1: 32, fig. 14. 1925; Kanehira, Form. Trees 373, fig. 328. 1936.

A completely glabrous tree with conspicuous lenticels on the second year's growth; leaves subcoriaceous, castaneous, oblong-elliptic, 5–11 cm. long, 2–4.5 cm. wide, the base obtuse, the apex shortly acuminate, the margin entire, the midrib plane or slightly impressed above, elevated beneath; inflorescences subumbelliform, solitary, axillary, the peduncles 7–15 mm. long, the pedicels 6–9 mm. long; fruits ovoid-globose, 4–5 mm. in diameter, the persistent stigma mammiiform; pyrenes 5, 4 mm. long, 1.5–2 mm. wide, smooth, deeply unicanaliculate on the back, the endocarp coriaceous.

CHINA: Taiwan: Sekiin, Kudo & Sasaki 15244 (TU); Lake Jitugelutan, Y. Kudo in 1929 (A).

The variety *hakkuensis* differs from typical *Ilex lonicerifolia* in being glabrous. There is much variation in the density of the ferrugineous indumentum of *Ilex lonicerifolia*, but the pubescence is always present at least in some degree. With species like *Ilex kwangtungensis* Merr., *Ilex macrocarpa* Oliv., and others, it is evident that the indumentum in the genus *Ilex* can be surprisingly variable. Since there are no other morphological differences nor any marked geographical differences of range between *Ilex lonicerifolia* Hayata and *Ilex hakkuensis* Yamamoto, I believe that this form is not worthy of more than varietal rank.

16. *Ilex sterrophylla* Merr. & Chun. in Sunyats. 5: 110. 1940.

*Ilex pedunculosa* sensu Merr. & Chun in Sunyats. 2: 265. 1935, non Miquel.

An entirely glabrous tree up to 15 m. high with a trunk as much as 70 cm. in diameter (ex Chun & Tso), with entire ovate or ovate-elliptic leaves, simple cymose axillary infructescences, small globose fruit and shallowly unicanaliculate pyrenes.

Branchlets stout, subterete, plicate-rugose; third year's growth 5–7 mm. in diameter, cinereous, the lenticels numerous, circular or deltoid; second year's growth rufous-castaneous, the lenticels conspicuous; current year's growth castaneous-nigrescent, plicate, very glabrous, 3–4 mm. in diameter, the terminal bud ovoid, the scales densely ciliate. Leaves occurring also on the second year's growth, rather crowded, 2–10 mm. apart; stipules obsolete; petioles 15–25 mm. long, one-fifth to one-fourth the length of the lamina, entirely glabrous, plane, the distal end evidently winged by the decurrent leaf-base; lamina coriaceous, completely glabrous, olivaceous or brunneous, ovate or elliptic, 5–8 cm. long, 2–4 cm. wide; base cuneate to subrotund, decurrent; apex acuminate, the acumen 5–10 mm. long; margin entire, very rarely obscurely 1- or 2-toothed; midrib elevated above, prominent underneath, glabrous, the lateral nerves in 8–10 pairs, obscure on both surfaces. Inflorescences cymose, glabrous, axillary, on current year's growth only; flowers 4- or 5-merous. Staminate inflorescences: cymes subumbelliform, 5–13-flowered; peduncles 15–30 mm. long, twice dichotomous; the secondary axes 1–2 mm. long, the bracts subulate, 1.25 mm. long, the pedicels 3–5 mm. long; calyx patelliform, glabrous, 4- or 5-lobed, the lobes deltoid or rounded, ciliate; corolla rotate, white (ex Lau), the petals oblong-obovate, one-fifth connate at the base; stamens 4 or 5, shorter than the petals, the anthers oblong, 1 mm. long; rudimentary ovary minute, ovoid, 1 mm. long, the center rostellate, with 4-parted apex. Pistillate inflorescences: cymes simple, 3-flowered; peduncles 12–23 mm. long, the pedicels 5–8 mm. long, the calyx ciliate; corolla as in the staminate flowers; staminodes three-fourths the length of the petals, the sterile anthers sagittate; ovary ovoid, 2 mm. wide, the stigma thickly discoid. Fruit ellipsoid, 7–9 mm. long, the persistent calyx explanate, 3 mm. across, rounded, ciliate, the stigma thickly discoid. Pyrenes 4, oblong, 5–6 mm. long, 3 mm. wide at the back, smooth, estriate, shallowly concave on the back, the endocarp coriaceous.



CHINA: Kwangtung: Yao-shan, S. S. Sin 11022 (NY). Kwangsi: Shang-sze, W. T. Tsang 22376 (A), 24365 (A, NY). Hainan: Fan-yah, N. K. Chun & C. L. Tso 44093 (A, NY, US); Poting, F. C. How 73683 (A, TYPE); Pak-sa, S. K. Lau 26567 (A); Lok-tung, S. K. Lau 27324 (A), 27334 (A); Five Finger Mt., F. A. McClure (CCC) 9387 (A).

INDO-CHINA: Mt. Bana, J. & M. S. Clemens 4380 (A).

*Ilex sterrophylla* was first described from Hainan Island, where it occurs as a tree up to 15 m. high with a trunk 70 cm. in diameter (ex Chun & Tso). Its whitish flowers appear in May (McClure) and its fruits become dull red in late September.

Many of the specimens cited above have been misidentified as *Ilex pedunculosa* Miq. or as *Ilex purpurea* Hassk. (equals *I. chinensis* Sims). Because of their dorsally concave pyrenes they are not *Ilex pedunculosa*, and because of their entire leaves and long petioles they are likewise not *Ilex chinensis*.

*Ilex sterrophylla* is closely related to *Ilex suaveolens* (H. Lévl.) Loes. These two species resemble each other in that they both have simple cymose infructescences with slender long peduncles and dorsally concave pyrenes. *Ilex suaveolens*, however, can easily be distinguished by its sharp serrate leaves.

17. *Ilex editicostata* H. H. Hu & Tang in Bull. Fan Mem. Inst. Biol. 9: 248. 1940.

A small tree or shrub up to 6 m. high, with large coriaceous lanceolate acuminate leaves, simple cymose infructescences, puberulent pedicels, large fruits, and unicanaliculate pyrenes.

Branchlets stout, nigrescent, plicate; second year's growth 5–6.5 mm. in diameter, grayish brown to nigrescent, longitudinally rimulose, the lenticels sparse, circular, inconspicuous, the leaf-scars large, semicircular, slightly elevated; current year's growth 4–5 mm. in diameter, subterete, plicate and ridged when dry, glabrous. Leaves occurring also on second year's growth, 3–16 mm. apart; stipules lacking; petioles unusually long, compressed, 12–26 mm. long, one-fifth to one-fourth the length of the lamina, 3 mm. wide, flattened above, slightly keeled, plicate-rugose beneath; lamina lanceolate, 5–12 cm. long, 2–4 cm. wide, base cuneate; apex acuminate, the acumen 5–15 mm. long, triangular; margins entire, slightly recurved when dry; midrib elevated on both surfaces, more prominent above, glabrous, the lateral nerves in 10–12 pairs, usually obscure on both surfaces, the reticulations sometimes evident. Infructescence a simple cyme with 1–3 fruits; peduncle 3–6 mm. long, compressed, glabrescent, the secondary axis completely lacking; bracts linear, obtuse, puberulent, up to 2.5 mm. long, deciduous; pedicels 4–7 mm. long, plicate-striate, puberulent or glabrescent with basal deltoid prophylla 0.5 mm. long. Fruit subglobose, 9–10 mm. in diameter, red, when dry brunneous-nigrescent, the stigma discoid, convex, its margins lobed; the persistent calyx explanate, 5–6 mm. in diameter, the lobes 5 or 6, ovate, obtuse, or rounded, entire, ciliate. Pyrenes 4–6. oblong in outline, 7–8 mm. long,

2.5 mm. wide, broadly but shallowly unicanalicate on the dorsal surface, the endocarp sublignescent.

CHINA: Chekiang: Tai-suan, *R. C. Ching* 2219 (A, US). Kweichow: Fan-ching-shan, *Steward, Chiao & Cheo* 691 (ISOTYPE, A, K, US). Kiangsi: Lung-nan, *S. K. Lau* 4637 (A, US), 4743 (A, US). Kwangsi: Shang-sze, *W. T. Tsang* 24460 (A); Kwei-ling, *W. T. Tsang* 28487 (US).

According to field notes, *Ilex editicostata* grows in forests at altitudes of 600–700 m. It is a small tree or shrub up to 6 m. high and has a smooth grayish bark. The fruit turns red in late October.

The species agrees with its relative *Ilex maclurei* Merr. in having thick coriaceous entire leaves and unicanalicate pyrenes. The latter differs in that the secondary axes of its infructescences are well developed, its pedicels are glabrous, and the midrib on the upper surface of its leaf is not impressed.

17a. *Ilex editicostata* var. *litseaefolia* (H. H. Hu & Tang), comb. nov.

*Ilex litseaefolia* H. H. Hu & Tang in Bull. Fan Mem. Inst. Biol. Bot. 9: 247. 1940.

Leaves smaller, 4–7.5 cm. long, 1.6–3.2 cm. wide, elliptic-lanceolate or ovate, the apex short-acuminate, the acumen 4–6 mm. long, triangular; peduncles 4–5 mm. long, glabrescent; pedicels 2–3 mm. long, puberulent (Keng, Tsang) or glabrescent (Steward); fruit 4–7 mm. in diameter; pyrenes 5, very shallowly sulcate.

CHINA: Chekiang: Tien-tai-shan, *C. Y. Chiao* 14522 (A); *Y. L. Keng* 1058 (ISOTYPE of *Ilex litseaefolia*, A, SS). Kweichow: San-chiang-hsien, *Steward & Cheo* 962 (A). Kwangtung: Mei-hsien, *W. T. Tsang* 21540 (A).

This variety is a shrub less than 4 m. high which grows at altitudes of 800–2100 m. It differs from the typical form of the species chiefly in its lower habit and its smaller leaves. When Hu and Tang proposed *Ilex editicostata* they distinguished it from *Ilex litseaefolia* on the basis of its more robust habit, larger and thicker leaves and larger fruit with 6–8 pyrenes. The number of pyrenes is not a constant character, for in dissecting fruits of the isotype (*Steward, Chiao & Cheo* 691) I found many with only 5 pyrenes. The lanceolate entire leaves with the midrib elevated on the upper surface, the simple cymose infructescence with puberulent pedicels, and the shallowly canaliculate pyrenes of *Ilex litseaefolia*, all agree with the characters of *Ilex editicostata*. Furthermore, in *R. C. Ching* 2219 the leaf-size is transitional. The lower smaller leaves are like the normal leaves of *Ilex litseaefolia*, and the upper larger ones are like those of *Ilex editicostata*. I therefore interpret *Ilex litseaefolia* as an ecotype from a somewhat higher altitude, and place it as a variety of *Ilex editicostata*.

17b. *Ilex editicostata* var. *chowii* (S. Y. Hu), comb. nov.

*Ilex chowii* S. Y. Hu in Ic. Pl. Omei. 2: pl. 157. 1946.

Leaves elliptic-lanceolate, 7–15 cm. long, 2.5–5 cm. wide; infructes-

cence with 3 or 4 fruits; peduncles 6–9 mm. long, compressed; pedicels 3–7 mm. long, entirely glabrous; calyx 5- or 6-lobed, glabrous, ciliate; fruits globose, 7–9 mm. in diameter, much wrinkled when dry; pyrenes 5 or 6, unicanalicate on the back.

CHINA: Szechuan: Mt. Omei, *H. C. Chow* 8138 (TYPE of *Ilex chowii*, Sz; ISOTYPE, A). Kwangsi: Kwei-lin, *W. T. Tsang* 28487 (A); Yao-shan, *C. Wang* 40342 (A).

This variety differs from the species chiefly in being entirely glabrous. In its coriaceous entire large leaves with acuminate tips, simple cymose infructescences, and unicanalicate pyrenes, it conforms to *Ilex editicostata*. It is also related to *Ilex maclurei* Merr., which differs in having well-developed secondary axes in the infructescences.

18. *Ilex ferruginea* Hand.-Mzt. Symb. Sin. 7: 657, *pl.* 10, *fig.* 24. 1933.

A shrub (ex Schneider) or a tree (ex Handel-Mazzetti) with pubescent branchlets, ovate remotely crenate-serrate leaves, short petioles, simple cymose axillary infructescences and small unicanalicate pyrenes.

Branchlets subterete, smooth; fourth year's growth 3–4 mm. in diameter, the lenticels minute, circular, sparse, the leaf-scars deltoid, slightly elevated; third and second years' growth puberulent, the lenticels lacking; current year's growth angular, densely villose, striate-sulcate, 1.5–2.5 mm. in diameter. Leaves found even on third year's growth, 8–12 mm. apart; stipules minute, buried in the indument; petioles short, 4 mm. long, one-thirteenth to one-tenth the length of the lamina, villose, flat or slightly grooved above; lamina coriaceous, olivaceous, villose especially along the midrib, ovate, those near the apex of the shoots ovate-elliptic, 2–5.5 cm. long, 1.5–3.5 cm. wide; base truncate or rounded, rarely cordate or obtuse; apex shortly acuminate, the acumen 3–4 mm. long; margins remotely crenate-serrate, the teeth nigrescent; midrib plane or very slightly impressed above, elevated beneath, villose on both surfaces, the lateral nerves in 8–10 pairs, obscure above, prominent underneath, the reticulations obscure. Staminate inflorescences: subumbelliform or cymose, 1–6-flowered, solitary, axillary to scales or leaves of the current year's growth; peduncles 5–10 mm. long, the pedicels 1–3 mm. long; secondary axis rarely developed, 1–2 mm. long; bracteoles lanceolate, pubescent; flowers 5–7-merous; calyx subcampanulate, pubescent, 2–3 mm. across, deeply 5–7-lobed, the lobes ovate-deltoid, 1 mm. long, obtuse, strongly ciliate; corolla rotate, 6 mm. across, the petals erose, eciliate, one-fifth connate at the base; stamens 5, equaling the petals in length, the anthers oblong; rudimentary ovary subglobose, the apex shortly rostellate, the beak densely hirsute. Infructescence a simple 3-flowered cyme found only on the current year's growth, axillary, villose; peduncles 6–10 mm. long, slightly enlarged at the distal end; bracts of the individual flowers linear-lanceolate, 5 mm. long, villose; pedicels 5–9 mm. long; prophylla basal, deltoid, minute. Fruit globose, 5–7 mm. in diameter, when dry shiny, castaneous, wrinkled, the stigma discoid, the persistent calyx explanate, 3–4 mm. in diameter, villose and ciliate, the lobes 4 or 5, broadly deltoid, acute. Pyrenes 5 (4–6 ex Handel-

Mazzetti), smooth, 2.5 mm. long, 1 mm. wide, and broadly unicanalicate on the back.

CHINA: Kweichow: Ping-chow, *Y. Tsiang* 7117 (NY). Yunnan: *F. Ducloux* 148 (NY); Tung-chuan, north of Yunnanfu [Kunming], *Handel-Mazzetti* 468 (ISOTYPE, A); *C. Schneider* 293 (A, K).

The description of the staminate flowers is drawn from *Ducloux* 148.

Judging by its indumentum, its simple infructescences, and its broadly sulcate pyrenes, *Ilex ferruginea* is closely related to *Ilex kwangtungensis* Merr. which differs in having larger chartaceous elliptic leaves (up to 15 cm. long) and larger pyrenes up to 10 mm. long.

When Handel-Mazzetti first collected in China he traveled with C. Schneider, starting in March 1914. His number 468, the type of *Ilex ferruginea*, was collected on the same day and in the same locality as *C. Schneider* 293. Most likely these specimens came from the same plant. On casual examination one gains the impression that the indumentum is ferrugineous, particularly along the midrib. On close examination, however, it is found that the supposedly ferrugineous color of the indumentum is due to the presence of minute particles of red earth lodged in it. This extraneous substance can be easily washed off; the pubescence is actually gray. Thus the specific name selected for the species is inappropriate. In his description of the fruits Handel-Mazzetti stated, "pyrenae 4-6, . . . dorso carinatae." Apparently he confused the dorsal and ventral sides. The pyrenes are not carinate on the back, but rather unicanalicate. Furthermore, he placed *Ilex ferruginea* in the section Microdontae. This section is characterized by fasciculate inflorescences. He was apparently misled because the toothing of the leaves resembles that of *Ilex corallina* Franch., which does belong in the Microdontae. The presence or absence of teeth and their shape are very unreliable characters for use in the classification of *Ilex*. Since the inflorescences of this species are cymose, solitary, and axillary, and the pyrenes are unicanalicate, its natural relationship is with *Ilex kwangtungensis* Merr.

19. *Ilex suaveolens* (H. Lévl.) Loes. in Ber. Deutsch. Bot. Ges. 32: 541. 1914; H. Lévl. Fl. Kouy-tchéou 201. 1914; Rehd. in Jour. Arnold Arb. 14: 239. 1933.

*Celastrus suaveolens* H. Lévl. in Fedde, Rep. Spec. Nov. 13: 263. 1914.

*Ilex purpurea* sensu Hand.-Mzt. Symb. Sin. 7: 655. 1933, in part; Rehd. in Jour. Arnold Arb. 14: 239. 1933, in part; non Hassk.

A beautiful, entirely glabrous evergreen tree with coriaceous ovate-lanceolate leaves, subumbelliform, rarely cymose inflorescences, peduncles mostly exceeding the petioles in length, small globose fruits and smooth ecanalicate or slightly dorsally impressed pyrenes.

Branchlets straight, the third year's growth ca. 5 mm. in diameter, cinereous, the lenticels minute, circular-ellipsoid, very numerous but inconspicuous, the leaf-scars obovate-deltoid, plane; current year's growth 3-4 mm. in diameter, castaneous or brunneous. Leaves occurring also on second year's growth, 3-15 mm. apart; stipules lacking or very minute



and caducous; petioles unusually long, compressed, 15–30 cm. long, 2 mm. wide, one-fifth to one-fourth the length of the lamina, plane above, narrowly winged by the decurrent leaf-base; lamina coriaceous, olivaceous or brunneous, ovate, elliptic or lanceolate, 5–10 cm. long, 2.5–4 cm. wide; base rounded, obtuse or cuneate; apex acuminate, the acumen 5–10 mm. long; margin crenate-serrate or sometimes subentire, the tips of the teeth nigrescent; midrib elevated on both surfaces, the lateral nerves in 11–14 pairs, obscure above, evident beneath, the reticulations of the veinlets inconspicuous. Inflorescence subumbelliform, rarely cymose, solitary, axillary, on the current year's growth; cymes 3–7-flowered, twice or more dichotomous; peduncles glabrous, slender and long for the genus, 15–35 mm. long, usually longer than the petioles, compressed, gradually enlarged at the distal end; secondary axes usually poorly developed, 0–2 mm. long; bracts lanceolate, 2.5 mm. long, often ciliate. Staminate inflorescences: pedicels slender, 3–8 mm. long, in fruit 1 cm. long; flowers reddish white (ex Steward and Cheo), 4- or 5-merous; calyx broad subcampanulate, 3 mm. across, the lobes 4 or 5, ovate-deltoid, 1 mm. long, 1.5 mm. wide at the base, glabrous, ciliate, acute; corolla rotate, 6–7 mm. across, the petals ovate-oblong, 3 mm. long, 2.5 mm. wide, reflexed, one-eighth connate at the base; stamens shorter than the petals, the anthers ovoid, oblong, 1.25 mm. long; rudimentary ovary globose, 1.5 mm. in diameter. Pistillate inflorescences: peduncles 1.5–2.5 cm. long; calyx and corolla as in the staminate flowers; staminodes one-half the length of the petals, the sterile anthers cordate; ovary ovoid, globose, 2 mm. in diameter, the stigma thick-discoid, 4- or 5-lobed. Fruit globose-pomiform, 5–6 mm. in diameter, red, when dry brownish red, the stigma mammiform or discoid. Pyrenes 4 or 5, oblong in outline, trigonous in cross-section, 4–5 mm. long, smooth, estriate, esulcate, sometimes slightly depressed along the median dorsal line, the endocarp thickly coriaceous or sublignescens.

CHINA: Chekiang: Sia-chu, *R. C. Ching* 1721 (A, NY, US), 2611 (A), 2614 (A); Ping-yung, *R. C. Ching* 2221 (US), 2172 (NY, US); Yen-tang, *H. H. Hu* 229 (A); Tai-shun, *Y. L. Keng* 294 (A). Kiangsi: Wu-ling, *Y. K. Hsiung* 5399 (A); Lin-ying-hsien, *Steward & Cheo* 363 (NY). Hupei (Hupeh): *E. H. Wilson* 2031 (A, K), (Veitch Exp.) 2031A (A, K). Kweichow: Kwei-yang (or Kouy-yang), *E. Bodinier* 2663 (TYPE, fragment and photo, A); Pin-fa, *J. Cavalerie* 17 bis (fragment and photo, A); Fan-ching-shan, *Steward, Chiao & Cheo* 791 (A), 930 (A); *Handel-Mazzetti* 10524 (A). Kwangsi: Lin-yuin, *Steward & Cheo* 363 (A); Kwei-lin, *W. T. Tsang* 28490 (A). Kwangtung: Sin-fung, *Y. W. Taam* 109 (A), 971 (A).

*Ilex suaveolens* is closely related to and intermediate between *Ilex chinensis* Sims and *Ilex sterrophylla* Merr. In its ovate-elliptic-lanceolate leaves with crenate-serrate leaf-margins it resembles *Ilex chinensis*, which differs in having canaliculate elongated pyrenes, 2- or 3-dichotomous cymose inflorescences, and peduncles of the infructescences shorter than the petioles. In the long-pedunculate loose subumbelliform inflorescences, depressed-globose fruits, and nearly smooth pyrenes, it resembles *Ilex sterrophylla* Merr., which differs in having entire leaves.

20. *Ilex mannei*ensis, sp. nov.

Arbor; ramulis puberulentibus; foliis chartaceis vel tenuiter coriaceis, ellipticis, 8–16 cm. longis, 2–4.5 cm. latis, basi rotundatis vel cuneatis et anguste decurrentibus, apice acuminatis, acuminibus 10 mm. longis deltoideis, brunneis; costa supra paullo elevata et dense villosa, subtus manifeste elevata flavo-tomentosa, maturitate glabrescente; nervis lateralibus utrinque 15–17, prominentibus; inflorescentiis solitariis, axillaribus, 3-floris, pedunculis 5–7 mm. longis, pedicellis 2 mm. longis; floribus 4–6-meris, calycibus 3 mm. diametro pubescentibus; corolla 6–7 mm. diametro, petalis sparsim ciliatis, staminodiis quam petalis brevioribus, ovario ovoideo, stigmate mammiforme; fructibus globosis, 9 mm. diametro, glabris; pyrenis 5 vel 6, laevibus, 8 mm. longis, dorso late sed non profunde 1-canaliculatis.

An evergreen tree up to 9 m. high with puberulent branchlets, chartaceous or thin-coriaceous lanceolate entire acuminate leaves, simple 3-flowered cymose inflorescences, very shortly pedicellate fruits, and unicanaliculate pyrenes.

Branchlets stout, plicate and rugose, brunneous; third year's growth 5 mm. in diameter, the lenticels numerous, circular, sometimes coalescent, conspicuous, the leaf-scars elevated, crescent-shaped, deltoid; second year's growth plicate, puberulent, the lenticels lacking; current year's growth yellowish pubescent with short curly hairs, subterete, plicate, the terminal buds ovate, 5 mm. long, the outermost scales yellowish pubescent, the inner ones glabrous, all densely ciliate. Leaves occurring also on second year's growth, 2–4 mm. apart; stipules wanting; petioles 15–20 mm. long, one-eighth to one-sixth the length of the lamina, yellowish pubescent when young, glabrescent at maturity, plane above, plicate-rugose beneath; lamina chartaceous or thin-coriaceous, brunneous, glabrous except on the midrib, elliptic, 8–16 cm. long, 2–4.5 cm. wide; base rounded to cuneate, narrowly decurrent; apex acuminate, the acumen up to 10 mm. long, deltoid; midrib slightly elevated and densely villose above, the indumentum persistent, elevated and yellowish tomentose beneath, the indumentum deciduous; the lateral nerves 15–17 pairs, prominent on both surfaces, parallel, anastomosing near the margin, the reticulations obscure above, evident beneath. Pistillate inflorescence a simple 3-flowered cyme, solitary, axillary, pubescent, on current year's growth; peduncles 5–7 mm. long, greatly compressed, in fruit 4 mm. wide; bracts minute, deltoid, ciliate; flowers 4–6-merous, their pedicels very short, 2–3 mm. long; calyx patelliform, 3 mm. across, puberulous, the lobes broadly deltoid or rounded, ciliate; corolla rotate, 6–7 mm. across, the petals oblong-ovate, sparsely ciliate, 3 mm. long, 2.5 mm. wide, one-sixth connate at the base; staminodes three-fourths the length of the petals, the sterile anthers ovoid; ovary ovoid, 2 mm. long, the stigmas mammiform. Staminate flowers not seen. Fruit globose, 9 mm. in diameter, castaneous when dry, the persistent calyx explanate, 5 mm. in diameter, 5- or 6-lobed, the lobes ciliate, the stigma discoid. Pyrenes 5 or 6, oblong in outline, trigonous in cross-section, back U-shaped, 8 mm. long, 2.5 mm. wide, smooth, shallowly but widely unicanaliculate on the back, the endocarp woody.

CHINA: Yunnan: Mannei, *A. Henry 9628* (TYPE, A; ISOTYPES, K, US); Mengtze, *A. Henry 11014* (A, K).

The description of the pistillate flower is drawn from *Henry 11014*.

In having the midrib yellowish tomentose beneath this species resembles *Ilex atrata* W. W. Sm., but the latter differs in having its leaves serrate, its pedicels longer than the peduncles, and its branchlets glabrous. In its entire leaves and indumentum it resembles *Ilex lancilimba* Merr., which differs in having very short peduncles and usually large solitary fruits.

21. *Ilex chinensis* Sims in Bot. Mag. 46: *pl.* 2043. 1819; Lindl. in Donn, Hort. Cantab. ed. 10, 52. 1823; DC. Prodr. 2: 14. 1825; P. N. Don in Donn, Hort. Cantab. ed. 13, 83. 1845; Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29(3): 40. 1881; Forbes & Hemsl. in Jour. Linn. Soc. Bot. 23: 115. 1886; Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 495 (Monog. Aquif. 1: 495). 1901.

*Ilex purpurea* Hassk. Cat. Hort. Bog. Alt. 230. 1844; Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 111 (Monog. Aquif. 1: 111). 1901; Rehd in Jour. Arnold Arb. 8: 156. 1927, et 14: 239. 1933; Hand.-Mzt. Symb. Sin. 7: 655. 1933; Cheng ex P'ei, in Contr. Biol. Lab. Sci. Soc. China 9(2): 171. 1934.

*Ilex oldhami* Miq. Ann. Mus. Bot. Lugd.-Bat. 3: 105. 1867, et Cat. Mus. Bot. Lugd.-Bat. 19, 167. 1870; Franch. & Sav. Enum. Pl. Jap. 1: 77. 1873; Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29(3): 25, 38, *pl.* 1, *fig.* 4. 1881; Forbes & Hemsl. in Jour. Linn. Soc. Bot. 23: 117. 1886; Dunn & Tutchter in Kew Bull. Add. Ser. 10: 60. 1912; Chung in Mem. Sci. Soc. China 1: 141. 1924; Belval in Mus. Heud. Not. Bot. Chin. 2: 21. 1933.

*Ilex lucida* Blume ex Miq. Cat. Mus. Bot. Lugd.-Bat. 167. 1870, nom. nud.

*Ilex purpurea* var. *oldhami* (Miq.) Loes. ex Diels in Bot. Jahrb. 29: 435. 1900, nom. nud.; et in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 112 (Monog. Aquif. 1: 112). 1901, et in Sarg. Pl. Wils. 1: 76. 1911; Chung in Mem. Sci. Soc. China 1: 141. 1924; Chen, Ill. Man. Chinese Trees 655, *fig.* 546. 1937. *Syn. nov.*

*Callicarpa cavaleriei* H. Lévl. in Fedde, Rep. Sp. Nov. 9: 455. 1911, et Fl. Kouy-Tchéou 439. 1915.

*Celastrus bodinieri* H. Lévl. in Fedde, Rep. Sp. Nov. 13: 263. 1914.

*Embelia rubro-violacea* H. Lévl. in Fedde, Rep. Sp. Nov. 10: 375. 1912, et Fl. Kouy-Tchéou 285. 1914.

*Symplocos courtoisii* H. Lévl. in Mem. Acad. Cienc. Art. Barc. III, 12: 256 (Cat. Pl. Kiang-sou 22). 1916.

*Sjroggi* vel *Namome* Kaempf. Amoen. Exot. 779. 1717.

*Namome* Kaempf. Ic. Sel. Pl. ed. Banks, *pl.* 35. 1791.

A large entirely glabrous evergreen tree up to 13 m. high, with shiny deep green crenate-serrate leaves, bright red ellipsoid drupes, and dorsally 1-canaliculate pyrenes.

Trunk 30 cm. in diameter; bark gray, smooth (ex Ching & Tso); branchlets terete, third year's growth 5 mm. in diameter, cinereous, the lenticels minute, circular-ellipsoid, numerous and inconspicuous, the leaf-

scars crescent-shaped or narrowly deltoid, slightly elevated; current year's growth 3 mm. in diameter, angular, plicate, castaneous-nigrescent, glabrous. Leaves occurring also on second year's growth, 3–10 mm. apart; stipules minute, deciduous; petioles 8–10 mm. long, one-eighth to one-sixth the length of the lamina, plane, sometimes slightly sulcate above, striate beneath, narrowly winged by the decurrent lamina; lamina thin-coriaceous, brunneous, elliptic, lanceolate or rarely ovate, 5–11 cm. long, 2–4 cm. wide; base obtuse or cuneate; apex acuminate, the acumen 5–10 mm. long; margin crenate or rarely serrate; midrib plane above, elevated beneath, the lateral nerves 6–9 pairs, rather obscure above, prominent beneath, glabrous, the reticulations evident beneath. Inflorescences cymose, solitary, axillary, glabrous, on current year's growth. Staminate inflorescences: cymes 7–15-flowered, 3 or 4 times dichotomous or sometimes irregularly dichotomous; peduncles 4–14 mm. long, usually exceeding the petioles; secondary axis well developed, 2–5 mm. long, the bracts of the ultimate cymules lanceolate, 2 mm. long, often ciliate; flowers lavender or red, 4- or 5-merous; pedicels 2 mm. long, glabrous with 0 or 1 deltoid ciliate prophyllum 0.5 mm. long; calyx subcampanulate, glabrous, ca. 2.5 mm. across, the lobes broadly deltoid, obtuse or rounded, ciliate; corolla rotate, the petals ovate, ca. 2.5 mm. long, 1.8 mm. wide, reflexed at anthesis; stamens shorter than the petals, the anthers ellipsoid, 1.5 mm. long; rudimentary ovary conic, 0.7 mm. long. Pistillate inflorescences: cymes 3–7-flowered, once or twice dichotomous; peduncles 3–10 mm. long, always shorter than the petioles, compressed, usually enlarged at the distal ends, the secondary axis poorly developed; pedicels 6–10 mm. long; calyx and corolla as in the staminate flowers; staminodes one-half the length of the petals, the sterile anthers cordate; ovary ovoid, the stigma thickly discoid, inconspicuously 4- or 5-lobed. Fruit ellipsoid, 10–12 mm. long, 6–8 mm. thick, shiny, red, when dry smooth, shiny, castaneous-nigrescent, the persistent stigma prominent, discoid, convex. Pyrenes 4 or 5, narrowly lanceolate in outline, trigonous in cross-section with a narrow U-shaped back, 9–11 mm. long, 2.5–3 mm. wide, smooth, deeply 1-canaliculate along the median dorsal line, the endocarp thick-coriaceous.

CHINA: Kiangsu: without precise locality, *Ch. d'Argy* in 1844–66 (TYPE of *Symplocos courtoisii*, photo and fragment, A); Shien-chuan-tze, *Ching & Tso* 453 (A); I-shing, *Ching & Tso* 481 (A); Y. L. Keng 2669 (A); K. King 12293 (NY); Ma-shan of Tai Lake, *Ching & Tso* 697 (A), 701 (A); Soochow, *Ching & Tso* 803 (A); Tso 1686 (A); Nanking, Y. Tsiang 337 (A); Tso 1722 (A). Anhwei: Wang-shan, W. C. Cheng 4550 (US); N. K. Ip 5116 (A); R. C. Ching 2758 (A); Chemen, R. C. Ching 3172 (A); Chiu-hwa-shan, R. C. Ching 7258 (US); C. S. Fan & Y. Y. Li 260 (US); Chien-shan, C. S. Fan & Y. Y. Li 127 (A). Chekiang: Hangchow, C. Y. Chiao 18877 (NY, US), 18820 (US), 18877 (US); Sia-chu, R. C. Ching 1588 (A, NY, US), 2597 (A), 4827 (A); Ping-yung, R. C. Ching 2142; Ning-po, E. Faber (NY); Tsing-tien, Y. L. Keng 124 (A), 232 (A); Tai-shun, Y. L. Keng 288 (A); I-wu,



*Y. L. Keng* 895 (A); *Hai-ning, T. N. Liu* 549 (NY). Kiangsi: Tungku, *Y. K. Hsiung* 615 (A); *H. H. Hu* 875 (A); Kien-nan, *S. K. Lau* 3922 (A, US), 4281 (A, US), 4397 (A, US); Lung-nan, *S. K. Lau* 4842 (A, US); Fow-liang, *K. Ling*, in 1924 (A); Ch'uan-Hsien, *W. T. Tsang* 27585 (A); Ling-chuan, *Y. Tsiang* 9831 (NY); Tsoong-jen, *Y. Tsiang* 10204 (NY); Tu-hwa Mountain, (ex Herb. Univ. Nank. 1562) (A). Kiangsi-Fukien Border: *T. H. Wang* 327 (A). Hupei (Hupei): Yang-hsien-hsien, *H. G. Cheo* 18343 (NY); Chien-shih, *H. C. Chow* 1438 (A, NY), 1554 (A, NY); En-shih, *H. C. Chow* 1877 (A, NY); western Hupei, *W. Y. Chun* 4004 (A); *A. Henry* 1562 (US), 3911 (B, US), 4440 (A), 6211 (A, NY, US); *E. H. Wilson* 868 (A, NY), 1925 (A, NY, US), 2193 (K), 2193A (K, NY), 2699A (K), 2700A (K); I-chang, *E. H. Wilson* 689 (A, US), 3096 (US), 3097 (A, US); Chang-yang, *E. H. Wilson* 1975 (K), 2697 (A, K, NY, US). Hunan: Sin-ning, *S. C. Fan & Y. Y. Li* 549 (A); *Handel-Mazzetti* 11291 (A); Chang-sha, *Handel-Mazzetti* 11415 (A), 11525 (A, US); Wu-kang, *Handel-Mazzetti* 11987 (A). Kweichow: Kwei-yang (kouy-yang), *E. Bodinier* 2384 (TYPE of *Celastrus bodinieri*, fragment, A); Doo-shan (Tou-shan), *J. Cavalerie* 2624 (TYPE of *Callicarpa cavaleriei*, fragment, A); without precise locality, *J. Esquirol* 429 (ISOTYPE of *Embelia rubro-violacea*, A); Wong-mo, Chen-feng, *S. W. Teng* 90962 (A); Kwei-ting, *Y. Tsiang* 5558 (NY), 9229 (NY); Tuh-shan, *Y. Tsiang* 6603 (NY); Yin-kiang, *Y. Tsiang* 7908 (NY), 7851 (NY); Tu-yun, *Handel-Mazzetti* 10730. Szechuan: O-mei-shan (Mt. Omei), *C. Y. Chiao & C. S. Fan* 271 (A); *C. L. Chow* 6084 (Sz), 6101 (Sz), 7172 (Sz); *H. C. Chow* 8222 (A), 12173 (A); *E. Faber* 20344 (NY); *W. P. Fang* 15412 (Sz), 15527 (Sz), 15619 (Sz), 15653 (Sz), 15671 (Sz), 15680 (Sz), 15700 (Sz), 18942 (Sz), 19115 (Sz), 19149 (Sz); *T. C. Lee* 3452 (Sz), 4536 (Sz), 4618 (Sz), 4782 (Sz); *C. L. Sun* 1224 (Sz); *S. C. Sun & K. Chang* 713 (A), 818 (A), 1548 (A); *L. Y. Tai* 473 (A), 1135 (A); *F. T. Wang* 23503 (A), 23653 (A); *C. Y. Yao* 5058 (SS); Chien-wei-hsien, *H. H. Chung* 241; without precise locality, *Faber* 20 (A); Kwan-hsien, *W. P. Fang* 12916 (Sz); *Y. L. Liu* 1927 (A); Pien-hsien, *Y. S. Liu* 2000 (A); Lo-shan-hsien, *F. T. Wang* 23546 (A); Kia-ting, *H. H. Tai* 135 (A), 243 (A); *L. Y. Tai* 1441 (A); western China (probably Szechuan), *E. H. Wilson* 3323 (K). Sikang: *C. Y. Chiao* 1683 (A). Yunnan: *A. Henry* 344 (NY). Fukien: Yen-ping, *H. H. Chung* 3532 (A); Ku-tien, *H. H. Chung* 7915 (A); Sin-kai-kau, *Dunn* 2472 (A); Foochow, *Tang Siu Ging* 7232 (A). Kwangtung: Tai-ping, *W. Y. Chun* 5669 (A); Lin-hsien, *C. O. Levine* (CCC) 3186 (A); Loh-ch'ang, *W. T. Tsang* 20771 (A, NY); Ch'uan-hsien, *W. T. Chang* 27585 (US); Lok-chong, *C. L. Tso* 20644 (NY); Yang-shan, *T. M. Tsui* 718 (NY), 497 (A, NY, US). Kwangsi: Kwei-ling, *W. T. Tsang* 27801 (A, US); Yao-shan, *C. Wang* 40621 (A). Hainan: Lok-tung, *S. K. Lau* 27274 (A).

JAPAN: *Buerger* (A); *R. Oldham* 149 (A), 150 (A), 151 (ISOTYPES of *Ilex oldhami*, A, G, NY); Herb. Lugd.-Bat. (ISOTYPE of *Ilex lucida*, NY); *G. Masamune* in 1915 (NY), in 1923 (NY), in 1940 (NY); *Maximowicz* (G, NY); *Kenzo Shiota* 5341 (A); *K. Sakurai* (A); *Jashiro* for *Wilson* (A).

*Ilex chinensis* is very well known among the Chinese, as it is extensively used as an ornamental tree. The branchlets with their deep green shiny

leaves and bright red fruits are used to decorate temple-courts and large halls during the period from December to February which includes the Chinese New Year. It is known as "Tung-ching," meaning "wintergreen," or "wan-sho-hong," meaning "everlasting red." It has been collected in thirteen Chinese provinces and on Hainan Island, at altitudes ranging from sea level in East China up to 2000 m. in West China. It is often cultivated, developing into a tree up to 12 m. high and forming a trunk up to 30 cm. in diameter. Its lavender flowers appear in May, and its fruits begin to turn red in September. Quantities of fruiting branches are sold for ornamental purposes at the time of the Chinese New Year festival in February. The young shoots are sometimes blanched and used for salad. The crushed pyrenes are reputed to have tonic effects and are used in medicine.

This beautiful ornamental plant attracted the attention of early European collectors in the coastal cities. It was introduced into England in 1810 (ex Donn). Sims in July, 1814, studied and illustrated a flowering male plant growing in Messrs. Malcolm & Sweet's Nursery said to have been introduced from China. He named it *Ilex chinensis* and published his description and colored plate in 1819. Apparently only male plants were then available in England and the species soon disappeared from cultivation there. DeCandolle in 1825 knew it only from Sims' illustration and suggested that it might be a synonym of *Ilex dahoon* Walt. = *Ilex cassine* Linn. The species was soon forgotten. Maximowicz in 1881 remarked concerning *Ilex chinensis*, "Planta nunc obsoleta videtur, a Goeppert in enumeratione *Ilicum hortensium* omissa . . . omnino omittitur." Forbes & Hemsley in their Enumeration of Chinese Flowering Plants regarded it as a doubtful species, stating, "The cymose, . . . inflorescence on peduncles exceeding the petioles is unknown to us among Chinese hollies, and there may be some error as to the origin of this species." Even Loesener in his Monographia Aquifoliacearum also listed *Ilex chinensis* as a species of doubtful status.

Before the eighteenth century Japan had essentially a Chinese culture. Many cultigens were introduced into that country from China, and among them this *Ilex* which I interpret as *Ilex chinensis*. In 1844 Hasskarl based his *Ilex purpurea* on specimens from Nanawe, Japan. Twenty-three years later Miquel based *Ilex oldhami* on specimens collected by Oldham at Nagasaki. Fruiting specimens received from various parts of China, of course, did not match Sims' illustration of the male plant, *Ilex chinensis*. Some were named *Ilex purpurea* and others *Ilex oldhami*, but finally the older of these two names became very generally accepted for this widely distributed Chinese species. Being now convinced that these numerous staminate specimens of the present species do represent the long obscure and misunderstood *Ilex chinensis*, I accept this name as the oldest valid one for the species and reduce *Ilex purpurea* Hassk. (1884), *Ilex oldhami* Miq. (1867), and *Ilex purpurea* Hassk. var. *oldhami* (Miq.) Loes. (1901) to synonymy. I agree with Rehder in the reduction of the several L  veill   binominals.

22. *Ilex kwangtungensis* Merr. in Jour. Arnold Arb. 8: 8. 1927; Groff in Lingnan Sci. Bull. 2: 64. 1930; Chun in Sunyats. 2: 71. 1934; Tanaka & Odashima in Jour. Soc. Trop. Agr. 10: 372. 1938; Chun in Sunyats. 4: 224. 1940; Merr. & Chun. in Sunyats. 5: 106. 1940; Masamune, Fl. Kainant. [Hainan] 174. 1943.

*Ilex kwangtungensis* var. *pilosior* Hand.-Mzt. Symb. Sin. 7: 654. 1933. *Syn. nov.*

*Ilex kwangtungensis* var. *pilosissima* Hand.-Mzt. op. cit. 655. *Syn. nov.*

*Ilex shaveliensis* Comber in Notes Bot. Gard. Edinb. 18: 57. 1933. *Syn. nov.*

*Ilex latifrons* Chun in Sunyats. 2: 69. 1934. *Syn. nov.*

*Ilex phanerophlebia* Merr. in Lingnan Sci. Jour. 13: 36. 1934. *Syn. nov.*

*Ilex latifrons* var. *pilosissima* (Hand.-Mzt.) Chun op. cit. 70. *Syn. nov.*

Small evergreen tree up to 9 m. high with puberulent branchlets and inflorescences, large ovate-elliptic finely serrate or subentire pubescent leaves, long lanceolate bracts, large ellipsoid fruits and deeply and broadly canaliculate pyrenes.

Branchlets straight, terete, the third year's growth 4-5 mm. in diameter, cinereous-brunneous, glabrescent, the lenticels minute, dense, circular, rather evident, the leaf-scars semicircular, slightly elevated; second year's growth 3 mm. thick, smooth, nigrescent or brunneous, cinereously puberulent under a lens; current year's growth angular, 2-3 mm. thick, ferrugineous or fulvous-pubescent. Leaves found even on third year's growth, 5-30 mm. apart; stipules lacking; petioles robust, 10-18 mm. long, 2 mm. thick, one-ninth to one-seventh the length of the lamina, triangular, narrowly sulcate above, fulvous-pubescent; lamina subcoriaceous, brunneous or atro-olivaceous, curly villose on both surfaces, sparsely so above, densely so beneath and along the midrib, ovate-elliptic, oblong or lanceolate, 7-16 cm. long, 3-6 cm. wide; base rounded or obtuse; apex acuminate, the acumen 5-10 mm. long; margin minutely serrate or subentire, slightly recurved; midrib plane or slightly elevated and densely villose above, very prominent, elevated and villose beneath, the lateral nerves 9-11 pairs, slightly impressed above, elevated beneath, the reticulation of the veinlets evident. Inflorescence a loose compound cyme, solitary, axillary, on current year's growth only. Staminate inflorescences: cymes 12-20-flowered, 3 or 4 times dichotomous, pubescent; peduncles 9-12 mm. long, secondary axes usually present 3-6 mm. long; bracts filiform, lanceolate, fulvous-villose, often up to 7 mm. long, basal to the tertiary axis; flower 4- or 5-merous, red or pink, 7-8 mm. across; pedicels 2 mm. long, fulvous-villose becoming nearly glabrous; calyx patelliform, 2.5-3 mm. across, the lobes orbicular-ovate, rounded, puberulous, entire, ciliate; corolla rotate, the petals oblong, 3.5 mm. long, 2 mm. wide, one-sixth connate at the base; stamens shorter than the petals, the anthers oblong, 1.5 mm. long; rudimentary ovary narrowly conical, 1.5 mm. long, the apex rostellate. Pistillate inflorescences: cymes 3-7-flowered, 1 or 2 times dichotomous, pubescent, the secondary axes 3-4 mm. long, the bracts lanceolate, submedian on the secondary axis; flowers 4-merous; pedicels

4–7 mm. long, flavous-villose or glabrescent; calyx ciliate; corolla rotate, the petals ovate, 2.5 mm. long; staminodes shorter than the petals, the sterile anthers ovoid; ovary ovoid, 2 mm. in diameter, the stigma mammi-form, 4-lobed. Fruit red, ellipsoid, 12 mm. long, 9 mm. in diameter, nigrescent when dry, brown, wrinkled, shiny, the persistent calyx explanate, ciliate, the stigma prominent, 4-lobed and slightly ridged. Pyrenes 4, smooth, 6 mm. long, 3 mm. wide on the back, dorsally unicanaliculate, the canal 2 mm. deep, 1.7 mm. wide, the endocarp sublignescens.

CHINA: Chekiang: Tai-suan, *R. C. Ching* 2142 (A, US). Fu-kien: Dunn, (Hongk. Herb. no. 2476) (A); Tien-hwa-schan (Ting-chow), *Handel-Mazzetti* 400 (ISOTYPE of *Ilex kwangtungensis* var. *pilosior*, A). Kwangtung: Lung-t'au Mt., *To, Tsang & Tsang* (CCC) 12741 (A), 12383 (A, LU, US), 12764 (A, LU, US); Pok-lor, *Fung Hom* A556 (= LU 18971, TYPE of *Ilex phanerophlebia*, NY); Wung-yuen, *S. K. Lau* 2393 (A); Sin-fung, *Y. W. Taam* 199 (A), 307 (A), 383 (A); Kow-loon, *Y. W. Taam* 2300 (A); Ta-pu, *W. T. Tsang* 21188 (A); Hwei-yang, *W. T. Tsang* 25607 (A), 25695 (A), 25899 (A). Hainan: Po-ting, *F. C. How* 72489 (A), 73047 (A), 73349 (A), 73730 (A); *C. Wang* 33520 (A, US); Lok-tung, *S. K. Lau* 26978 (A); Bo-ting, *S. K. Lau* 28021 (A), 28277 (A). Kwangsi: Kwei-lin, *W. T. Tsang* 28122 (A, US); Yao-shan, *C. Wang* 39321 (A), 39376 (A). Hunan: Chang-ning-hsien, *C. S. Fan & Y. Y. Li* 259 (A). Kweichow: Tuh-shan, *W. Y. Chun* 6977 (A, US); *Y. Tsiang* 6977 (NY). Yunnan: *G. Forrest* 15947 (ISOTYPE of *Ilex shweliensis*, A).

The characters Chun and Handel-Mazzetti used to set off *Ilex latifrons* and its varieties and *Ilex kwangtungensis* var. *pilosior* fall within the range of variation exhibited by the original material of *Ilex kwangtungensis*. It is almost identical with *To, Tsang & Tsang* (CCC) 12383, a paratype of that species. *Wang* 33520 from Hainan fits the description of *Ilex latifrons* Chun very well, it being but a large-leaved form of *Ilex kwangtungensis*. With abundant material I can find no tangible characters to differentiate Chun's species and Handel-Mazzetti's varieties from *Ilex kwangtungensis*. The curly indumentum of the branchlets, inflorescences, and vegetative characters of *Forrest* 15947 conform to *Ilex kwangtungensis*; its pyrenes, however, are smaller, and the canals are shallower.

*Ilex kwangtungensis* is related to *Ilex chinensis* Sims, but the latter has very glabrous branchlets and inflorescences, smaller pyrenes with narrow and shallow dorsal canals.

The pink staminate flowers and the red pistillate flowers of *Ilex kwangtungensis* appear in May and June. The fruits turn greenish yellow in August–October and become red at maturity in November.

23. *Ilex atrata* W. W. Smith in Notes Bot. Gard. Edinb. 10: 40. 1917;  
Anon. in Notes Bot. Gard. Edinb. 17: 167. 1930; Comber in op.  
cit. 18: 40. 1933.

An evergreen tree with large terminal buds, ciliate bud-scales, large chartaceous or thin-coriaceous, finely serrate leaves, flavous-tomentose



midribs, simple cymose infructescences, and convex pyrenes, slightly impressed at one end on the back.

Branchlets subterete, castaneous-nigrescent; second year's growth 3–4.5 mm. in diameter, when dry plicate-sulcate, the lenticels rather numerous, obscure or evident, the leaf-scars slightly elevated, crescent-shaped; current year's growth 3–4 mm. in diameter, angular, glabrous, the terminal buds large (especially when unfolding in October), the bud-scales ovate, the outer ones 8 mm. long, 5 mm. wide, slightly keeled, their margins entire and densely ciliate. Leaves 5–10 mm. apart; stipules lacking; petioles 15–25 mm. long, one-eighth to one-fifth the length of the lamina, 3 mm. wide, plane or slightly canaliculate above, plicate-rugose beneath, glabrous; lamina chartaceous or thin-coriaceous, castaneous or brunneous, elliptic, 12–16 cm. long, 3.5–5 cm. wide; base rounded, obtuse or broadly cuneate; apex acuminate, the acumen 10–12 mm. long with margins finely serrate or crenate-serrate; midrib prominent, plane, glabrous above, much elevated and flavous-tomentose beneath, sometimes glabrescent, the lateral nerves 14–18 pairs, prominent on both surfaces, the reticulation dense, evident on both surfaces. Infructescence a simple cyme, axillary to the leaves of the current year's growth, 1–3-flowered, glabrous; peduncles 2–3 mm. long, the pedicels 5–8 mm. long; persistent calyx explanate, 4 mm. in diameter, the lobes ovate, minutely and very shortly ciliate. Fruit globose, 6 mm. in diameter, red, when dry brunneous-nigrescent, shiny, wrinkled, the stigma discoid, 4- or 5-lobed. Pyrenes 5, oblong in outline, trigonous in cross-section, 5.5 mm. long, 2.5 mm. wide at the back, smooth, estriate, esculate, the dorsal surface slightly impressed at the basal end, the endocarp coriaceous.

CHINA: Yunnan: Teng-yueh, *G. Forrest 9419* (ISOTYPE, A).

UPPER BURMA: Nam Tamai Valley, *Kingdon Ward 13228* (B).

In the leaf-form, size, and texture, and in the simple cymose infructescences, *Ilex atrata* closely resembles *Ilex kwangtungensis* Merr., which differs in having pubescent inflorescences, large drupes with deeply unicanaliculate pyrenes. When Smith described the species he mentioned the terminal bud as 2 cm. long. The terminal bud of the isotype in the Arnold Arboretum is in the unfolding stage. It is 2 cm. long, and the bud scales are loose. I think that the ciliate bud scales are a more significant character than the size of the bud. Although various collectors have visited the classical locality since this species was described, they have apparently not rediscovered the plant.

23a. *Ilex atrata* var. *wangii*, var. nov.

Arbor; ramulis glabris; foliis chartaceis, ellipticis, 15 cm. longis, 4.5–5.5 cm. latis; costa subtus elevata, tomentosa; inflorescentiis cymosis, puberulentibus; pedunculis 10 mm. longis; pedicellis 5 mm. longis; calycibus puberulentibus, ciliatis; pyrenis 7, dorso planis vel canaliculatis.

CHINA: Yunnan: Chiu-kiang, West of Champutung, *C. W. Wang 67359* (TYPE, A).

This variety differs from the species chiefly in having the peduncles longer than the pedicels, both being puberulent, but the single collection seen is not fully mature. The infructescence is of the same type as that of *Ilex manneiensis* S. Y. Hu, but because of the serrate margins and tomentose midrib I place it as a variety of *Ilex atrata*.

SERIES 2. UMBELLIFORMES (LOES.), STAT. NOV.

*Ilex* subgen. *Euilex* Loes. ser. *Lioprinus* Loes. sect. 1. *Excelsae* Loes. subsect. a, *Umbelliformes* Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 95 (Monog. Aquif. 1: 95). 1901.

Evergreen trees; leaves subcoriaceous or chartaceous, entire; inflorescences cymose or subumbelliform, solitary, axillary in current year's growth; flowers 4–10-merous; petals distinctly one-fourth to one-sixth connate; stamens equal to or slightly longer than the petals; rudimentary ovary rostellate, the beak 3–7-cleft at the apex; fruits medium- to small-sized; pyrenes 4–10, usually 5 or 6, 3-striate, 2-sulcate or rarely esulcate, the endocarp coriaceous, sublignified or woody.

KEY TO THE SPECIES

- A. Pyrenes smooth or 3-striate, esulcate; endocarp coriaceous. (Himalaya, Yunnan, Kwangsi) . . . . . 24. *I. excelsa*.
  - AA. Pyrenes 3-striate and sulcate; endocarp sublignified or woody.
    - B. Staminate inflorescence a loose cyme, the peduncle 3–13 mm. long; fruit ellipsoid or globose; calyx erose eciliate (very rarely ciliate in *I. rotunda* var. *microcarpa*).
      - C. Leaves (4–)5–8(–9) cm. long, 2–4 cm. wide, the petioles 1–2 cm. long, one-fifth to one-fourth the length of the lamina; rudimentary ovary rostellate. (Japan, East and South China) . . . . . 25. *I. rotunda*.
    - CC. Leaves (2–)3(–4.5) cm. long, 1–2 cm. wide, the petioles 4–6 mm. long, one-tenth to one-eighth the length of the lamina. (Hainan) . . . . . 26. *I. angulata*.
  - BB. Staminate inflorescence an umbel, the peduncle 14–20 mm. long; fruit depressed-globose or globose, when dry ochraceous or brunneous; calyx ciliate.
    - C. Branchlets pubescent; fruit ca. 3.5 mm. in diameter; pyrenes 5 or 6, ca. 2 mm. long. (Himalayan region to Hainan) . . . . . 27. *I. godajam*.
    - CC. Branchlets glabrous; fruit ca. 6 mm. in diameter; pyrenes 6–10, 2.5–4 mm. long. (Himalaya) . . . . . 28. *I. umbellulata*.
24. *Ilex excelsa* (Wall.) Hook. f. Fl. Brit. Ind. 1: 603. 1875; Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29 (3): 23. 1881; Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 104 (Monog. Aquif. 1: 104). 1901; Chung in Mem. Sci. Soc. China 1: 140. 1924; Comber in Notes Bot. Gard. Edinb. 18: 46. 1933.
- Cassine excelsa* Wall. in Roxb. Fl. Ind. 2: 376. 1824; Spreng. Syst. 4: Cur. Post. 124. 1827.

*Ilex elliptica* D. Don, Prodr. Fl. Nep. 189. 1825; DC. Prodr. 2: 15. 1825.

*Ilex rotunda* sensu D. Don, l.c., non Thunb.

*Ilex doniana* DC. op. cit. 644.

*Ilex nepalensis* Spreng. Syst. 4: Cur. Post. 48. 1827.

*Ilex exsulca* Wall. List no. 4328. 1830; Brandis, For. Fl. Brit. Ind. 76. 1874.

An evergreen tree up to 10 m. high with chartaceous or subcoriaceous elliptic entire leaves, solitary cymose inflorescences, small ovoid-ellipsoid fruits and 5, rarely 4 or 6, smooth or striate, esulcate pyrenes.

Branchlets rugose and angular; third year's growth 4 mm. in diameter, cinereous, with few lenticels; second year's growth 3 mm. in diameter, plicate-rugose; current year's growth 2 mm. in diameter, ridged, glabrous, the terminal buds poorly developed, with loose glabrous scales. Leaves on current year's growth only, 3–10 mm. apart; stipules lanceolate, 1–1.5 mm. long, acute; petioles slender, 10–12 mm. long, about one-seventh the length of the lamina, glabrous, narrowly canaliculate above; lamina chartaceous or subcoriaceous, brunneous-olivaceous, opaque on both surfaces, elliptic or oblong-elliptic, 5–10 cm. long, 2–3.5, rarely 5 cm. wide; base cuneate, obtuse or rarely rounded; apex acuminate, the acumen 5–12 mm. long, mucronate; margin entire; midrib impressed above, elevated beneath, glabrous, the lateral nerves 7 or 8 pairs, evident on both surfaces, anastomosing near the margin, the reticulations of the veinlets obscure. Inflorescences cymose, solitary, cymes 3–7 (–15) -flowered, the bracts deltoid, acute, the flowers 4–6-merous. Staminate inflorescences: peduncles 4–8 mm. long, hirsute, the pedicels 2–5 mm. long, puberulous with 1 or 2 basal prophylla; calyx patelliform, deeply 4- or 5-lobed, the lobes rounded, eciliate; corolla rotate, 5 mm. across, the petals oblong, 2 mm. long, eciliate, one-sixth connate at the base; stamens equal or slightly longer than the petals, the anthers oblong, 1 mm. long; rudimentary ovary pulvinate, long-rostellate, the beak evident, 1 mm. long, with distinctly 5-cleft apex. Pistillate inflorescences: peduncles 5–12 mm. long, minutely puberulous, the pedicels 3–4 mm. long; calyx 2.5 mm. across, 5- or 6-lobed, the lobes deltoid, eciliate; corolla rotate, 5 mm. across; the petals broad-ovate, 2 mm. long; staminodes one-half the length of the petals, the anthers sagittate; ovary ovoid, 1.5 mm. in diameter, the stigma discoid. Fruit ovoid-ellipsoid, 5 mm. in diameter, the persistent calyx explanate, 2.5 mm. across, the stigma thickly discoid, convex. Pyrenes usually 5, occasionally 4 or 6, elliptic in outline, trigonous in cross-section, 2.75 mm. long, 1.25 mm. wide, smooth or 2- or 3-striate, esulcate, the endocarp coriaceous.

CHINA: Kwangsi: Yung-hsien, Steward & Cheo 757 (A, NY), 838 (A, NY). Yunnan: Shweli-Salween Divide, G. Forrest 15865 (A), 16062 (A); Mengtze, A. Henry 13691 (A); Lung-ling-hsien, H. T. Tsai 55633 (A); without precise locality, Wang, Chang & Liu 85048 (A); Mien-ning, T. T. Yu 17829 (A).

NEPAL: Wallich 4328 (ISOTYPE, G; fragment, A), 4328A (A).

INDIA: Himalayan region, Griffith 2008 (A, G), Thomson (G);

Kangra, *Parker 3317* (A); Kumaon, *Strachey & Winterbottom 1* (G); Khasia Mountains, *Hooker & Thomson* (G).

The chartaceous elliptic acuminate entire leaves, the cymose inflorescences, and the rostellate rudimentary ovary of *Ilex excelsa* indicate a close relationship between this species and *Ilex rotunda* Thunb. of Japan and eastern China. The latter usually has larger fruits and striate-sulcate pyrenes. The variations in the size of the fruits of the Japanese species and in the striation of the pyrenes of the Chinese material are so great that it is difficult to decide to which species specimens collected from areas like Kwangsi, which are geographically intermediate between the two, should belong.

24a. *Ilex excelsa* var. *hypotricha* (Loes.), comb. nov.

*Ilex hypotricha* Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 103 (Monog. Aquif. 1: 103). 1901.

Branchlets puberulous; leaves chartaceous, puberulous on the lower surfaces or only along the midrib beneath, oblong-elliptic, 5–8 cm. long, 2.5–4 cm. wide, shortly acuminate; inflorescences cymose, solitary, the flowers 4- or 5-merous; fruit small, ellipsoid, ca. 5 mm. long, 3 mm. wide; pyrenes 5, 4 mm. long, 1.25 mm. wide, 3-striate, esulcate, the endocarp coriaceous.

CHINA: Yunnan: without precise locality, *G. Forrest 17938* (A), *18014* (A), *27200* (TYPE, A); Ping-pien-hsien, *H. T. Tsai 60502* (A).

INDIA: East Bengal, *Griffith 2008* (A, fragment; G, ISOTYPE of *Ilex hypotricha*).

This variety differs from typical *Ilex excelsa* in its puberulent branchlets and lower leaf-surfaces. The Yunnan form is a shrub or small tree.

25. *Ilex rotunda* Thunb. Fl. Jap. 77. 1784; Willd. Sp. Pl. 1 (2): 711. 1797; Pers. Syst. Veg. 174. 1797, et Syn. Pl. 1: 151. 1805; Poir. in Lam. Encycl. Suppl. 3: 67, 1813; Roem. & Schult. Syst. 3: 492. 1818; DC. Prodr. 2: 16. 1825; Spreng. Syst. 1: 496. 1825; Dietr. Syn. Pl. 1: 555. 1839; Sieb. & Zucc. in Abh. Bay. Ak. Wiss. IV, 2: 149. 1845; Miq. Ann. Mus. Bot. Lugd.-Bat. 3: 106 (Prol. Fl. Jap. 106). 1867; Franch. & Sav. Enum. Pl. Jap. 1: 77. 1873; Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29(3): 23. 36, *pl. 1*, *fig. 5*. 1881; Hance in Jour. Bot. 21: 296. 1883; Forbes & Hemsl. in Jour. Lin. Soc. Bot. 23: 118. 1886; Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 106 (Monog. Aquif. 1: 106). 1901; Hayata, Ic. Pl. Form. 1: 134. 1911; Lecomte, Fl. Gén. Indo-Chine 1: 851. 1912; Chung in Mem. Sci. Soc. China 1: 141. 1924; Kanehira, Form. Trees 386, *fig. 337*. 1936; Kia, Pl. Sin. Ill. 492, *fig. 833*. 1937; Chen, Ill. Man. Chin. Trees 656, *fig. 547*. 1937; Masamune Fl. Kainant. [Hainan] 175. 1943; Tardieu-Blot in Fl. Gén. Indo-Chine Suppl. 1: 767. 1948.

*Ilex laevigata* Blume ex Miq. Cat. Mus. Bot. Lugd.-Bat. 167. 1870.

*Ilex kosunensis* Yamamoto, Suppl. Icon. Pl. Formos. 1: 36, *fig. 16*. 1925. *Syn. nov.*



*Ilex sasakii* Yamamoto, op. cit. 39, fig. 19. 1925. *Syn. nov.*

A large, entirely glabrous evergreen tree reaching 20 m. in height and developing a trunk as much as 1 m. thick, with entire leaves, loose simple umbelliform cymes, ellipsoid fruit, 3-striate and 2-sulcate lanceolate pyrenes.

Branches straight, rough, with slightly elevated obovate or deltoid leaf-scars; third year's growth 4–5 mm. in diameter, cinereous, obscurely rimulose, the lenticels inconspicuous; current year's growth 2–3 mm. thick, fuscous, longitudinally ridged, glabrous. Leaves occurring on current year's growth only, 1–10 mm. apart; stipules minute, 0.5–1 mm. long, subulate, deciduous; petioles 10–20 mm. long, one-sixth to one-fourth as long as the lamina, glabrous, canaliculate above, striate and rugose beneath; lamina thin-coriaceous or chartaceous, olivaceous or brunnescent, entirely glabrous, ovate to obovate or elliptic, 4–9 cm. long, 1.8–4 cm. wide; base cuneate or obtuse; apex shortly acuminate, the acumen deltoid, 5–8 mm. long, the tip cuspidate; margin entire, narrowly recurved; midrib slightly impressed above, elevated beneath, especially toward the basal half, the lateral nerves 6–9 pairs, obscure above, visible beneath, reticulate near the margin, the tertiary veins inconspicuous. Inflorescences cymose or umbelliform, cymes (3–) 4–6 (–13) -flowered, solitary, axillary, on current year's growth only. Staminate inflorescences: peduncles 3–10 mm. long, the pedicels 4–5 mm. long with 0–2 brown deltoid basal acute prophylla; flowers 4-merous; calyx patelliform, 2 mm. across, shallowly 4-lobed, the lobes deltoid, eciliate; corolla rotate and reflexed, 6 mm. across, the petals oblong, 2.5 mm. long, 1.5 mm. wide, one-sixth connate at the base; stamens longer than the petals, the anthers ellipsoid; rudimentary ovary pulvinate, 1 mm. in diameter, the middle rostellate, with the beak 5- or 6-cleft at the apex. Pistillate inflorescences: peduncles 9–13 mm. long, 3–7-flowered, glabrous, the pedicels 4–8 mm. long, glabrous; flowers white, 5–7-merous; calyx subpatelliform, 2 mm. in diameter, glabrous, the lobes deltoid, erose, 0.5 mm. long, 0.75 mm. wide; corolla rotate, the petals one-fifth connate, the lobes obovate-oblong, 2 mm. long, 1.5 mm. wide; staminodes three-fourths the length of the petals, the filaments much dilated at the base, the sterile anthers cordiform; ovary ovoid-conic, 2 mm. long, the stigma subglobose. Fruits ellipsoid, 6–8 mm. long, the stigma capitate when young, discoid and 5–7-lobed at maturity. Pyrenes 5–7, lanceolate in outline, trigonous in cross-section, ca. 6 mm. long, 1.25 mm. wide, 3-striate, 2-sulcate on the dorsal surfaces, the sides smooth, the endocarp sublignified.

CHINA: Chekiang: Sia-chu, *R. C. Ching* 1796 (A, US); Chuan-hsien, *Y. L. Keng* 736 (A). Hunan: Yi-chang, *W. T. Tsang* 23724 (US). Fukien: Hing-hwa, *H. H. Chung* 975 (A); Ku-liang, *H. H. Chung* 6636 (A). Kwangtung: Ren-hwa, *W. Y. Chun* 5616 (A), 5638 (A); Lo-chang, *Y. Tsiang* 1423 (A); Lok-chang, *C. L. Tso* 20945 (NY). Kwangsi: Seh-feng-dar-shan, *R. C. Ching* 7803 (NY, US); Shang-sze, Shap-man-tai-shan, *W. T. Tsang* 22102 (A). Hainan: Dung-la, *N. K. Chun & C. L. Tso* 43358 (A, NY); Ching-mai, *C. L. Lei*

488 (A, NY); Taam-chau, *Tsang & Fung* 440 (NY); *W. T. Tsang* 497 (A); without precise locality, *H. Y. Liang* 64514 (NY, US); *L. Tang* 410 (A); *C. Wang* 34337 (NY). Taiwan: South Cape, *A. Henry* 929 (NY), 1973 (US); Takao Province, *Y. Kudo* in 1928 (A); without precise locality, *N. Fukuyama* 7317 (TU), *E. Matuda* 1212 (TU), *Nakamura* 3952 (TU); Taihoku, *S. Sasaki* in 1929 (A, TU); Kosshu Province, *E. H. Wilson* 11042 (A).

JAPAN: *K. Beattie & Y. Kurihara* 10452 (A); *Buerger* (A, G); *U. Faurie* 3844 (A); *Goto* 4803 (A); *Maximowicz* (G), in 1863 (NY); *K. Miyabe* (A); *R. Oldham* 142 (G), 143 (G), in 1862 (ISOTYPE of *Ilex laevigata*, NY); *Siebold* (A); *Sargent* (A); *T. Tanaka* 100420 (A); *E. H. Wilson* 6157 (A), 6209 (A), 7828 (A), 8157 (A). Liu-kiu Islands: *U. Faurie* 3805 (A); *Yokohama Nursery Co.* (A, NY).

KOREA: *U. Faurie* 497 (A), 1633 (A, B), 1636 (A, B), 1640 (A); *T. Taquet* 144 (A), 2720 (A), 3922 (A), 3923 (A), 4462 (A); *E. H. Wilson* 9556 (A).

INDO-CHINA: Tonkin: *A. Pételot* 889 (US), 1200 (A); *W. T. Tsang* 27364 (A), 29989 (A).

*Ilex rotunda* was first described from Japan and stated to be an entirely glabrous plant. This typical form has been collected from a few coastal provinces in China and Indo-China. In China the plant becomes a tree and develops a trunk up to 30 cm. in diameter. The white fragrant flowers appear in April, and the red fruit lasts until February or March of the following year.

**25a. *Ilex rotunda* var. *microcarpa* (Lindl. ex Paxt.), comb. nov.**

*Ilex microcarpa* Lindl. ex Paxt. *Fl. Gard.* 1: 43. 1850; *Loud. Encycl. Pl. Suppl.* 2: 1302. 1855.

*Ilex rotunda* sensu Forbes & Hemsl. *Jour. Linn. Soc. Bot.* 23: 118. 1886; sensu Dunn & Tutchener in *Kew Bull. Add. Ser.* 10: 59. 1912; sensu Loes. in *Sarg. Pl. Wils.* 1: 78. 1911; sensu Chien in *Contr. Biol. Sci. Soc. China* 3: 58. 1927; sensu Rehd. in *Jour. Arnold Arb.* 7: 156. 1927; sensu Groff in *Lingnan Sci. Bull.* 2: 64. 1930; sensu Belval in *Mus. Heud. Not. Bot. Chin.* 2: 22. 1933, non Thunb.

An evergreen tree with chartaceous entire leaves; lamina oblong-elliptic, rarely ovate, 5–9 cm. long, 2.5–4 cm. wide, the base obtuse, rarely rounded or cuneate, the apex shortly acuminate and cuspidate; inflorescences subumbelliform 3–13-flowered; the peduncles 5–12 mm. long, the pedicels 2–6 mm. long, both minutely puberulous; flowers 4–7, usually 6-merous, the calyx erose, rarely sparsely ciliate; fruit globose, rarely ovoid or ellipsoid, 5 mm. in diameter, very rarely 7 mm. in diameter; pyrenes 6, rarely 5 or 7, elliptic in outline, in cross-section trigonous, 4 mm., rarely 5–6 mm. long, the back 1 mm. wide, 3-striate, 2-sulcate, the sides smooth, the endocarp sublignified.

CHINA: Kiangsu: I-shing, *Ching & Tso* 621 (A). Anhwei: Wangshan, *W. C. Cheng* 3885 (US); *R. C. Ching* 2914 (A, US); Chimen, *R. C. Ching* 3157 (A), 3329 (A). Chekiang: Yen-tang-shan, *C. Y. Chiao* (ex Herb. Univ. Nanking no. 14741) (A, US); Hangchow, *C. Y. Chiao* (ex Herb. Univ. Nanking no. 18814) (NY, US); Sia-chu, *R. C. Ching* 1688

(A, US), 2566 (A, US); T'ing-tien, *Y. L. Keng* 204 (A); Nin-hai-hsien, *Y. L. Keng* 1099 (A); Ning-po, *D. MacGregor* (A). K'iang-si: Ku-ling, *W. Y. Chun* 4301 (A); *E. H. Wilson* 1611 (A); Shang-yu-hsien, *H. H. Hu* 912 (A); Ta-yu-hsien, *H. H. Hu* 977 (A); Kien-nan-hsien, *S. K. Lau* 3963 (A, US). Hunan: Chang-ning-hsien, *C. S. Fan & Y. Y. Li* 421 (A). Kweichow: Fang-chin-shan, *Steward, Chiao & Cheo* 841 (A, US). Fukien: Min-how-hsien, *Tang Siu-ying* 6786 (A); *H. H. Chung* 2080 (A), 6617 (A, NY), 6764 (A), 6868 (A); *J. B. S. Norton* 1573 (US). Kwangtung: Shao-chow, *W. Y. Chun* 5507 (A); Ta-ching, *W. Y. Chun* 5510 (A); Ma-hang, *W. Y. Chun* 5547 (A); Ren-hwa, *W. Y. Chun* 5616 (A), 5638 (A); Chang-kiang, *W. Y. Chun* 6115 (A); Ting-wu-shan, *W. Y. Chun* 6470 (A, US); *C. O. Levine* (CCC) 737 (A, US), 3096 (A); Kook-kiang, *S. P. Ko* 50419 (NY). Wung-yuen-hsien, *S. K. Lau* 656 (A, NY, US), 692 (A, NY), 2220 (A, US); Kao-yao, *S. Y. Lau* 20237 (NY); Canton, *C. O. Levine* (CCC) 1 (A, US), 656 (A, US), 1205 (US), 1299 (A, US), 1656 (A, US), 1815 (A, US), 1830 (A, US), 2110 (A), 2177 (A); Lin-hsien, *C. O. Levine* (CCC) 3366 (A, US); Lung-t'au Mt., *To, Tsang & Tsang* (CCC) 12206 (US); Po-tau-chai, *F. A. McClure* 232 (A); Sam-shu, *F. A. McClure* 1348 (US); Loh-fau Mt., *Fung Hom* 556 (NY); *E. D. Merrill* 10249 (A), 10891 (A); Sin-fung-hsien, *Y. W. Taam* 280 (A), 584 (A), 771 (A), 1049 (A); Chung-shaan, *W. T. Tsang* 2 (NY); Ta-pu-hsien, *W. T. Tsang* 21190 (A, NY); Hwei-yang-hsien, *W. T. Tsang* 25732 (A); *T. M. Tsui* 102 (US); Jen-hwa-hsien, *W. T. Tsang* 26437 (A); Ting-wu-shan, *Y. Tsiang* 784 (A), 1495 (A); Ko-chow, *Y. Tsiang* 912 (A); Lo-fou-shan, *Y. Tsiang* 1679 (A); Sun-wui-hsien, *Y. Tsiang & Tso* 2017 (A); Ho-yuen, *C. L. Tso* 21553 (NY), 21554 (NY); Lung-chun, *C. L. Tso* 21653 (NY); Ko-chong, *C. L. Tso* 20421 (NY), 20658 (NY), 20848 (NY); Yang-shan-hsien, *T. M. Tsui* 514 (NY, US), 627 (A, NY, US); Chu-don, *C. Wang* 472 (A). Kwangsi: Lu-chen: *R. C. Ching* 5221 (NY); Shang-sze: *W. T. Tsang* 24503 (NY). Hongkong: *N. C. Chun* 40207 (NY); *C. Ford* (NY); *Y. Tsiang* 2949 (NY). Hainan: Dung-ka, *N. K. Chun & C. L. Tso* 43827 (NY); Yai-chow, *F. C. How* 70446 (A, NY); Po-ting, *F. C. How* 71509 (A), 71737 (A), 72606 (A); Lok-tung, *S. K. Lau* 26757 (A); Bak-sa, *S. K. Lau* 26296 (A); Ching-mai, *C. L. Lei* 1 (NY, US); Seven Finger Mts., *H. Y. Liang* 61775 (A, NY); No-dao, *F. A. McClure* (CCC) 7705 (A); without precise locality, *J. L. Gressitt* 838 (A), 1119 (B); Ch'ang-kiang, *S. K. Lau* 1899 (A, NY); Taam-chau, *W. T. Tsang* 70 (A, US), 364 (NY, US), 497 (NY, US); *C. Wang* 34280 (A, NY), 35117 (A, NY), 35727 (NY). Taiwan: Tai-hoku-syu, *K. Odashima* (ex Herb. Taihoku Imp. Univ. no. 17759) (A, NY, US); *S. Suzuki* (A); Lake Candiduis, *R. Kanehira* 21336 (A); *E. H. Wilson* 11121 (A, US), 11180 (A, US).

The specimens from Fukien have rather small inflorescences. They even suggest *Ilex stewardii* S. Y. Hu. but for the most part they are poorly selected and are not to be considered as typical. The variety differs from typical *Ilex rotunda* in having puberulous peduncles and pedicels. In general its fruits are smaller and its pyrenes are shorter and less sulcate.

The cultivated plants that Lindley saw in Standish and Noble's Bagshot Nursery were introduced by R. Fortune during his second trip to China, 1848-50. On this trip he collected in Shanghai and in the vicinity of

Ning-po. He also proceeded from Ning-po across the province of Chekiang to southern Anhwei. He states that his objective was to discover the secret of manufacturing tea. On this trip he was handicapped by fear and suspicion. For this reason, he probably could not collect many specimens from the interior parts of Anhwei and Chekiang. It is most likely that his original material of *Ilex microcarpa* came from the vicinity of Ning-po, where it is common.

In fruit-size, leaf-texture, and the indumentum of the inflorescences, the variety resembles *Ilex excelsa* (Wall.) Hook. f. more closely than *Ilex rotunda*. Because of the striate-sulcate pyrenes I place it as a variety of *Ilex rotunda* Thunb. As I interpret the group, *Ilex rotunda* var. *microcarpa* is a variant intermediate between the Japanese *Ilex rotunda* and the Himalayan *Ilex excelsa*.

26. *Ilex angulata* Merr. & Chun in Sunyats. 2: 266. 1935.

An evergreen shrub or small tree up to 4 m. high with striate puberulent twigs, entire chartaceous elliptic-lanceolate leaves, solitary or cymose infructescences, large ellipsoid fruits and striate-sulcate pyrenes with rough excavated backs.

Branchlets slender, zigzag; fourth year's growth usually 3–4 mm. in diameter, angularly ridged, rimose, the lenticels lacking, the leaf-scars semi-orbicular; third and second year's growth thinner, puberulent; current year's growth very slender, 1–1.5 mm. in diameter, ridged and narrowly canaliculate, pubescent in the grooves, the terminal buds lacking. Leaves occurring even on the third year's growth, 2–8 mm. apart; stipules minute, subulate and falcate, persistent; petioles short, 4–6 mm. long, one-tenth to one-eighth the length of the lamina, canaliculate above; lamina chartaceous or membranaceous, olivaceous, broad-elliptic, elliptic or lanceolate, 2.5–4.5 cm. long, 1–2.3 cm. wide; cuneate or acute at the base; acuminate and cuspidate at the apex, the acumèn 5–8 mm. long; margin entire, very rarely near the apex inconspicuously but sharply serrulate; midrib sulcate and puberulent above, prominent, elevated and glabrous beneath, the lateral nerves 5–7 pairs, rather obscure on both surfaces. Inflorescences solitary, axillary, only on current year's growth, pubescent; cymes simple, 1–3-flowered, when 1-flowered the pedicels short, 3–5 mm. long, with 2 sub-basal prophylla, when 2- or 3-flowered the peduncles 3–5 mm. long, the pedicel subequal; bracts to individual flowers deltoid, sparsely pubescent. Staminate inflorescences: cymes usually 3-flowered, calyx patelliform, 3–5 mm. across, deeply 5-lobed, the lobes membranaceous, suborbicular, 1.5 mm. long and wide, eciliate, rounded or obtuse; corolla rotate, 6–8 mm. across, the petals ovate, 3 mm. long, 2–2.5 mm. wide, one-sixth connate at the base; stamens three-fourths the length of the petals, the anthers oblong; rudimentary ovary globose, 1 mm. in diameter. Pistillate inflorescences: calyx and corolla as in the staminate flowers; staminodes one-third the length of the petals, the sterile anthers sagittate; ovary ovoid, the stigma mammiform, discoid at the apex, 2.5 mm. long, 2 mm. wide at the base; rudimentary ovary globose, 1 mm. in



diameter. Fruit ellipsoid, 6–7 mm. long, 5–6 mm. in diameter, striate and sulcate, dark brown, the persistent calyx explanate, 5 mm. in diameter, the style evident, the stigma discoid, irregularly lobed. Pyrenes 5 or 6, 5 mm. long, 1.5 mm. wide, the dorsal surface 3-striate and sulcate, the middle ridge usually deeply impressed, the endocarp lignescens.

CHINA: Hainan: Po-ting, *F. C. How* 71993 (A); Dung-ka, *N. K. Chun & C. L. Tso*, 43779 (ISOTYPE, A; TYPE, NY), 43781 (A, NY); without precise locality, *C. Wang* 34675 (NY, US).

This species is endemic to Hainan Island. There it grows at altitudes of 450–500 m. Its pink staminate flowers appear in April (ex How).

26a. *Ilex angulata* var. *longipedunculata*, var. nov.

Frutex pubescens; foliis late ellipticis, 2.5–4.5 cm. longis, 1.5–2.3 cm. latis, apice acuminatis; inflorescentiis cymosis, pedunculis 8–10 mm. longis, pedicellis aequilongis, pedicellis fructibus solitariis 15–18 mm. longis, pubescentibus; fructibus ellipsoideis, 9–10 mm. longis, 6 mm. diametro; pyrenis 5 mm. longis, striatis, endocarpio sublignescens.

CHINA: Hainan: Po-ting, *F. C. How* 72497 (A), 73020 (TYPE, A).

This variety differs from the typical *Ilex angulata* in having larger fruiting pedicels and fruits.

27. *Ilex godajam* (Colebr.) Wall. List. no. 4329. 1839; Hook. f. *Fl. Brit. Ind.* 1: 604. 1875; Loes. in *Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur.* 78: 101 (Monog. Aquif. 1: 101). 1901; Maxim. in *Mém. Acad. Sci. St. Pétersb.* VII, 29 (3): 23. 1881; Pitard in *Lecomte, Fl. Gén. Indo-Chine* 1: 854. 1912; Tardieu-Blot in *Fl. Gén. Indo-Chine Suppl.* 1: 767. 1948.

*Prinos godajam* Colebr. ex Wall. *Pl. As. Rar.* 3: 38, *pl.* 261. 1832.

*Ilex godajam* var. *genuina* Kurz in *Jour. As. Soc. Bengal.* 44(2): 158. 1875.

*Ilex capitellata* Pierre, *Fl. For. Cochinch.* 4: *pl.* 278b. 1893.

*Ilex godajam* var. *capitellata* (Pierre) Loes. op. cit. 102. 1901. *Syn. nov.*

*Ilex rotunda* Thunb. var. *piligera* Loes. op. cit. 108.

*Ilex umbellulata* sensu Merr. in *Lingnan Sci. Jour.* 6: 327. 1928, non Loes.

*Ilex fabrilis* sensu Merr. & Chun in *Sunyats.* 5: 106. 1940, non Pierre.

*Ilex rotunda* sensu auct. plur., non Thunb.

An evergreen shrub or tree up to 8 m. high, with pubescent branchlets, entire thin-coriaceous or chartaceous leaves, umbelliform inflorescences, small globose fruit, and minute 3-striate and 2-sulcate pyrenes.

Branchlets crooked, the third year's growth 5 mm. in diameter, subterete, light cinereous, the lenticels lacking, the leaf-scars semi-orbicular, not elevated; second year's growth 4 mm. in diameter, striate; current year's growth 2 mm. in diameter, pubescent, brown, the terminal bud lacking or very weak. Leaves occurring also on second year's growth, 10–20 mm. apart; stipules minute, broadly deltoid, acute; petioles very slender, 10–15 mm. long, one-ninth to one-fourth the length of the lamina, pubescent, narrowly canaliculate above; lamina thin-coriaceous or chartaceous, olivaceous, when young silky, especially on the lower surface, ovate or oblong,

5–8 cm. long, 2.5–4.6 mm. wide; base rounded, seldom obtuse; apex obtuse or very short-acuminate, the acumen 3–5 mm. long, broadly deltoid; margin entire; midrib impressed, often puberulent above, strongly elevated and pilose or glabrescent beneath, the lateral nerves 7–11 pairs, straight and parallel, curved upward near the margin, the reticulation of the veinlets obscure. Inflorescences umbelliform, axillary, on current year's growth, pilose, often when the shoot fails to develop appearing paniculate; flowers 4–6-merous. Staminate inflorescences: umbels 8–23-flowered; peduncle 14–18 mm. long, the secondary axes often evident, 1–2 mm. long, the pedicel 2–4 mm. long, with 2 subulate basal prophylla; flowers 4- or 5-merous; calyx patelliform, 2.5 mm. across, pubescent, deeply 4- or 5-lobed, the lobes ovate, obtuse, erose and ciliate; corolla rotate, the petals oblong, ca. 2 mm. long, 1 mm. wide; one-eighth connate at the base; stamens equaling the petals in length, the anthers ovoid, 0.5 mm. long; rudimentary ovary globose, 0.75 mm. in diameter, rostellate, the beak 4- or 5-cleft. Pistillate inflorescences: umbels 3–13-flowered; peduncles 10–13 mm. long, the bracts minute, deltoid, crowded and imbricate; pedicels 2–5 mm. long, with deltoid acute basal prophylla; calyx as in the staminate flowers; corolla and staminodes not seen; ovary ovoid, 1.5 mm. in diameter, constricted below the capitate stigma. Fruit globose, small, 3.5 mm. in diameter, the exocarp thin. Pyrenes 5 or 6, small, 2 mm. long, 1.5 mm. wide at the back, 3-striate, 2-sulcate, the endocarp woody.

CHINA: Hainan: Nodda, *W. Y. Chun* 4633 (US); Yai-chow, *F. C. How* 70672 (A), 70462 (NY, US), 70473 (NY), 71056 (A, NY); *F. C. How & N. K. Chun* 70198 (A, NY, US); *C. Wang* 33205 (A, US); Man-ning, *F. C. How* 71430 (A); Ngai-hsien, *S. K. Lau* 390 (A, NY, US); without precise locality, *H. Y. Liang* 63135 (NY, US), 64952 (NY), 65364 (NY); Taam-chau, *W. T. Tsang* 36 (LU 16785) (A, NY, US); *C. Wang* 34295 (NY). Kwangsi: Tian-chen, *R. C. Ching* 7803 (A), 7314 (A, NY, US), 7315 (NY); Tai-chin-shan, *S. P. Ko* 55103. Yunnan: Che-li-hsien, *C. W. Wang* 77582 (A).

INDO-CHINA: Tonkin: *Harmand* 1297 (isotype of *Ilex capitellata*, P); *Du Pasquier* 3026 (A); *A. Pételot* 6400 (A).

INDIA: *E. O. Shebbean* 11776A (A); Assam, *Prain's Collector* 765 (A), Reporter on Economic Products 11223 (A); *J. O. Voigt* 416 (A).

*Ilex godajam* was originally based on material from Silhet and Assam and described as pubescent. Additional collections indicate that it has a much wider distribution than the closely related glabrous species *Ilex umbellulata* (Wall.) Loes. It flowers about April (from late March to early May) and matures its red fruit in late August.

*Ilex godajam* is closely related to *Ilex umbellulata* (Wall.) Loes., and is perhaps merely a pubescent variety of it. The two are alike in their pseudo-umbelliform, long-pedunculate, pubescent inflorescences. However, whereas *Ilex godajam* is pubescent on branchlets, petioles, midribs, and often young leaves, *Ilex umbellulata* is glabrous. In general, *Ilex godajam* also has smaller leaves and fruits, thinner exocarp, and less sulcate pyrenes. It has another close relative in *Ilex rotunda* Thunb. var. *microcarpa* (Lindl.

& Paxt.) S. Y. Hu, which differs in having glabrous branchlets and elliptic leaves with cuneate bases and long-acuminate apices.

28. *Ilex umbellulata* (Wall.) Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 99 (Monog. Aquif. 1: 99). 1901; Pitard in Lecomte, Fl. Gén. Indo-Chine 1: 862. 1912; Tardieu-Blot in Fl. Gén. Indo-Chine Suppl. 1: 767. 1948.

*Ehretia umbellulata* Wall. in Roxb. Fl. Ind. 2: 344. 1824; Wall. List no. 4329. 1829. 1832; Spreng. Syst. 4: Cur. Post. 66. 1827.

*Ilex sulcata* Wall. List no. 4330, nom. nud.; Hook. f. Fl. Brit. Ind. 1: 604. 1875, descr.

*Pseudehretia umbellulata* (Wall.) Turcz. in Bull. Soc. Nat. Mosc. 36: 607. 1863.

*Ilex godajam* (Colebr.) Wall. var. *sulcata* (Wall.) Kurz in Jour. As. Soc. Bengal 44(2): 158. 1875.

*Ilex umbellulata* var. *megalophylla* Loes. op. cit. 2: 272. 1908; Chung in Mem. Sci. Soc. China 1: 141. 1924. *Syn. nov.*

A large evergreen tree up to 18 m. high, with trunk up to 40 cm. in diameter, glabrous branchlets, large entire oblong leaves, axillary sub-umbelliform inflorescences, globose small fruits with 6–10 3-striate, 1- or 2-sulcate pyrenes.

Branchlets rather crooked, roughened by elevated scars of former flowering shoots; third year's growth 4 mm. thick, cinereous, longitudinally plicate, the lenticels usually small, inconspicuous; current year's growth 2–3 mm. in diameter, brown or castaneous, glabrous. Leaves occurring even on the third year's growth, 5–15 mm. apart; stipules subulate, falcate, acute, 1.25 mm. long; petioles slender, 8–10 mm. long, one-fifteenth to one-ninth as long as the lamina, glabrous, canaliculate above, rugose beneath; lamina chartaceous, membranaceous when young, olivaceous, opaque on both surfaces, oblong, 10–15 mm. long, 5–6.2 mm. wide; base rounded or obtuse; apex obtuse or very shortly and abruptly acuminate, the acumen 5 mm. long, broadly deltoid; margin entire, often undulate, when dry very narrowly recurved; midrib impressed and glabrous above, strongly elevated beneath, the lateral nerves in 9–12 pairs, evident above, prominent beneath, curving upward and anastomosing near the margin, the reticulation of the veinlets obscure. Inflorescences subumbelliform, axillary, at the basal parts of the newly developed branches and often, when the branches fail to develop, appearing paniculate. Staminate inflorescences: individual pseudo-umbels 6–16-flowered, the bracts broad-deltoid, scaly, 1 mm. wide; peduncles 18–30 mm. long, puberulent, the pedicels 3–5 mm. long, puberulent, with deltoid acute basal prophylla; flowers 4- or 5-merous; calyx patelliform, puberulent, 2–3 mm. across, deeply 4- or 5-lobed, the lobes semi-orbicular, 1 mm. long, 1 mm. wide at the base, pubescent and ciliate; corolla rotate, the petals oblong, 2 mm. long, 1.5 mm. wide, one-eighth connate at the base; stamens slightly longer than the petals, the anthers ovoid, 0.75 mm. long; rudimentary ovary pulvinate, 1 mm. in diameter, rostellate, the beak acute, 4- or 5-cleft at the apex. Pistillate flowers not seen. Fruit globose or depressed-globose, 6 mm. in diameter,

red, very fleshy, rather smooth or slightly striate-sulcate, the exocarp rather hard, brown, the stigma thickly discoid or cristate. Pyrenes 6–10, trigonous or laterally much compressed, suborbicular in outline, 2.5–4 mm. long, 1.5–2.5 mm. wide on the dorsal surface, 3-striate, 1- or 2-sulcate, the endocarp woody.

CHINA: Yunnan: Szemao, *A. Henry* 11926 (A, K), 13486 (TYPE of *Ilex umbellulata* var. *megaphylla*, A; K); Lan-tsang-hsien, *C. W. Wang* 73370 (A); Fo-hai, *C. W. Wang* 74938 (A); Che-li-hsien, *C. W. Wang* 75648 (A), 75956 (A), 75881 (A), 77805 (A), 77815 (A), 77854 (A), 78050 (A), 78765 (A), 79105 (A); Jenn-yeh-hsien, *C. W. Wang* 80554 (A).

INDIA: Tenasserim & Andamans: *J. W. Helfer* ex Herb. East India Company no. 1998 (G); Bengal: *J. W. Helfer* in 1836–38 (duplicates of material used by J. D. Hooker for the description of *Ilex sulcata* Wall., A); Chittagong Hill Tracts, *King's Collector* in 1887 (419) (A).

*Ilex umbellulata* was originally described from Silhet and Assam, India, as a glabrous plant with pubescent umbelliform inflorescences. In China it has been collected in mixed forests of southwestern Yunnan at an altitude of 780–1350 m. There its white flowers appear in April. Its red fruits mature in late August or September (ex Wang).

Both of the Helfer specimens are immature, the flowers not fully open. The leaves of these two specimens are membranaceous, as J. D. Hooker described them, but they are not fully grown. The texture and size of the leaves of King's Collector 419 are the same as in *Henry* 13486, holotype of *Ilex umbellulata* var. *megaphylla* Loes., as is the case with the other specimens. I see no reason to maintain the Yunnan form as a large-leaved variety.

#### SECTION VI. PALTORIA (RUIZ & PAVON) MAXIMOWICZ

*Ilex* sect. *Paltoria* (Ruiz & Pavon) Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29 (3): 20, 21. 1881. TYPE SPECIES: *Ilex Paltoria* Pers. = *Paltoria ovalis* Ruiz & Pavon = *Ilex ovalis* (Ruiz & Pavon) Loes.

*Paltoria* Ruiz & Pavon, Fl. Peruv. Prodr. 2, pl. 33, fig. 1–9. 1797, et Fl. Peruv. 1: 54, pl. 84, fig. b. 1798. TYPE SPECIES: *Paltoria ovalis* Ruiz & Pavon.

*Ilex* subgenus *Euilex* Loes. series *Paltoria* (Ruiz & Pavon) Loes. in Verhandl. Bot. Ver. Brandenb. 33: 26. 1891, et in Engler & Prantl, Nat. Pflanzenfam. Nachtr. 218. 1897.

*Ilex* subgenus *Aquifolium* (Gray) Rehd. sect. *Lioprinus* (Loes.) Rehd. Man. Cult. Trees Shrubs 343. 1927, et Bibliog. Cult. Trees Shrubs 401. 1949, pro parte.

Shrubs: low creeping or up to 5 m. high; leaves coriaceous or subcoriaceous, serrate or crenate, rarely subentire or entire, the lower surface glandular-punctate or epunctate; staminate inflorescences fasciculate on the second year's growth or solitary on the current year's growth, the



pistillate flowers usually solitary, rarely 3-flowered cymose, axillary on the current year's growth (occasionally fasciculate in *Ilex triflora*); flowers 4-merous, rarely 5- or 6-merous, the petals of the pistillate flower one-fifth connate at the base; fruit 6-9 mm. in diameter, with thin exocarp and mesocarp; pyrenes 4 (rarely 5, or 6 in *Ilex sugeroki*), large, smooth or rarely slightly rugose on the dorsal surface, striate, esulcate, the endocarp coriaceous.

#### KEY TO THE SERIES

- A. Leaves punctate; pyrenes 4, ca. 4 mm. wide, striate with the striae usually slightly insculpt. .... Series 1. *Stigmatophorae*.
- AA. Leaves not punctate; pyrenes 4 or sometimes 5 or 6, 2-3 mm. wide, estriate or (in *Ilex pedunculosa* Miq.) longitudinally unistriate on the back. .... Series 2. *Cassinoides*.

#### SERIES 1. STIGMATOPHORÆ (LOES.), STAT. NOV.

*Ilex* subgen. III *Euilex* Loes. ser. C. *Aquifolium* (Tournef.) Maxim., sect. 3. *Microdonta* Loes. subsect. c. *Stigmatophorae* Loes. in Engler & Prantl, Nat. Pflanzenfam. Nachtr. 220. 1897, et in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 343 (Monog. Aquif. 1: 343). 1901.

Puberulent shrubs or small trees with coriaceous or subcoriaceous, crenate or serrate, punctate leaves, 1-7-flowered fasciculate, or solitary, cymose, staminate inflorescences, uniflorous fasciculate or solitary pistillate inflorescences, 4-merous (rarely 5-7-merous) flowers, depressed-globose or subglobose black fruits, and 4 large smooth striate coriaceous pyrenes, sometimes slightly ridged on the back.

The characters of various members of this section are rather uniform. The chief differences seem to be in leaf-form and indumentum, which in their case prove very unstable characters for taxonomic work. The section includes two strongly contrasted elements, the northern, *Ilex crenata* Thunb., a low shrub with small obtuse or acute leaves, and the southern, *Ilex triflora* Blume, a shrub or small tree with usually larger, shortly acuminate leaves. Variants intermediate between the two occur in the warm-temperate China and in Taiwan. These might be treated as weak species or as varieties of either element. The distribution of all species of this series is illustrated on the following map.

#### KEY TO THE SPECIES

- A. Fruits solitary, axillary to leaves, rarely to scales on current year's growth; staminate inflorescences 1-7-flowered, when cymose the peduncles (up to 5 mm. long) longer than the pedicels; rudimentary ovaries subglobose.
- B. Leaves shiny above, the midribs depressed; flowers 4-merous; calyx 5 mm. across, rounded and entire; stigma of fruit applanate, conspicuous, 2.5 mm. in diameter, rounded; pyrenes subrugose, slightly ridged on the back. (Anhwei to Kwangtung).....29. *I. viridis*.
- BB. Leaves usually opaque above, the midribs plane or slightly impressed; flowers 4-7-merous; calyx 3 mm. across, erose or dentate;

stigmas of fruit slightly elevated, small, 1 mm. in diameter, distinctly 4-lobed; pyrenes smooth, striate, the striae slightly impressed.

C. Leaves small, usually 1–3 cm. long, the apex obtuse or acute, never acuminate, lateral nerves 2 or 3 on each side of the midrib; pedicel of fruit 4–5 mm. (rarely longer) long; flowers 4-merous. (Japan, cultivated in North China).....30. *I. crenata*.

CC. Leaves 4–7 cm. long, the lateral nerves 6 or 7 on each side of the midrib, the apex shortly acuminate; pedicels of fruit 8–10 mm. long; flowers 4–9-merous. (Central and West China).....31. *I. szechwanensis*.

AA. Fruits usually fasciculate, axillary to leaves of second year's growth, rarely solitary on undeveloped current year's branchlets; staminate inflorescences 1–3 (rarely more)-flowered, when cymose the pedicels equaling or longer than the peduncles, which are 1–2 mm. long; pyrenes smooth, estriate, esulcate; rudimentary ovary pyramidal. (Java to southeastern Asia).....32. *I. triflora*.

As far as our specimens indicate, the northern element, *Ilex crenata* Thunb., does not reach Taiwan or even the Liu Kiu Islands. Yamamoto in 1925 reported *Ilex crenata* Thunb. var. *scoriatum* W. W. Sm. [*scoriarum*] from Taiwan. Koidzumi in 1929 thought that "The formosan plants differs from SMITH'S species in having glabrous petioles, . . . fasciculate female inflorescences, leaves not glanduloso-punctate on the under surfaces." He named this Liu Kiu species *Ilex scoriatulum*. I have not seen his material, but in *Gressitt 608*, which I assume to represent the same plant, the branchlets are puberulous, the leaves obovate, shortly acuminate or acute, 3–4.5 cm. long, 1.5–2.5 cm. wide, the petioles 7–10 mm. long, one-fourth the length of the lamina. The long petioles distinguish it from the rest of the Stigmatophorae. Its punctate leaves and large pomiform-subglobose fruits are like those of *Ilex viridis* Champ. ex Benth. If this is what Koidzumi meant by *Ilex scoriatulum*, then his species is a valid one.

Belonging to this section are three other species occurring beyond the area covered by this work. They are *Ilex thomsonii* Hook. f. (1875) from Himalaya, *Ilex luzonica* Rolfe (1886) from the Philippine Islands, and *Ilex radicans* Nakai (1930) from Japan. Merely on the basis of leaf size and form Loesener in 1901 reduced Hooker's species to a variety of *Ilex crenata* Thunb. and Rolfe's species to a form of the same species. Of *Ilex thomsonii* Hook. f. I have seen three specimens cited by Loesener, *Griffith 2003* from East Bengal (G), *Griffith 520* (G), and *Hooker & Thomson ex Herb. Ind. Or. no. 9* (G), also a small-leaved form from Sumatra, *Hamel 596* (NY, US), and *Yates 2008* (NY). The leaves of these specimens are 1.5–3 cm. long, and vary from broadly elliptic to ovate and even obovate, and the apices from acute to obtuse or even round. The staminate inflorescences are fasciculate, 1–3-flowered. When cymose, the peduncles are shorter than the pedicels. The fruits are solitary only on the current year's growth. *Hooker & Thomson 9* is intermediate between the Bengal and the Sumatra specimens. Since it shares characters with both the northern and the southern elements in the section

and has a different geographic distribution, I consider it better to retain *Ilex thomsonii* Hook. f. as a distinct small-leaved species of the Indo-Malayan region.

Concerning *Ilex luzonica* Rolfe, of which *Eurya myrtilloides* Elm. is a synonym, I have examined the following specimens: *Elmer* 7784, 8810, 9105, 11464, 11670, and *Merrill* 1571. The tuberculate branchlets, the retuse apex of the leaf, the 4-6-merous flowers, and the smooth estriate pyrenes are characters strong enough to warrant retaining it as a distinct species.

*Ilex radicans* Nakai (1930) is a creeping plant with leaves like those of *Ilex crenata* Thunb., but larger. It occurs in Asia at the northernmost limits not only of the section *Stigmatophorae* but also for the genus *Ilex*, being known only from Yezo and Sachalin.

29. *Ilex viridis* Champ. ex Benth. in Hook. Jour. Bot. Kew Gard. Miscel. 4: 329. 1852; Walp. Ann. 4: 430. 1857; Benth. Fl. Hongk. 65. 1861; Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29 (3): 46. 1881; Forbes & Hemsl. in Jour. Linn. Soc. Bot. 23: 118. 1886; Dunn & Tutcher in Kew. Bull. Add. Ser. 10: 59. 1912; McClure in Lingnan Sci. Bull. 3: 25. 1931; Belval, Mus. Heud. Not. Bot. Chin. 2: 22. 1933.

*Ilex triflora* var. *viridis* (Champ.) Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 345 (Monog. Aquif. 1: 345). 1901; Rehd. in Jour. Arnold Arb. 8: 157. 1927; Chien in Contr. Biol. Sci. Soc. China 3: 58. 1927.

An evergreen shrub or small tree up to 5 m. high with ovate, obovate, or broadly elliptic serrate conspicuously punctate leaves, solitary fruits, conspicuous stigmas 2.5 mm. in diameter, and sublignified pyrenes slightly ridged on the back.

Branchlets subquadrangular; third year's growth 3-5 mm. in diameter, subterete, greenish, strongly ridged, the lenticels oblong, elliptic, forming 2 longitudinal lines between the ridges; second year's growth ridged and angular, the ridges glabrous, the furrows puberulous, the leaf-scars semi-orbicular; current year's growth 2 mm. in diameter, ridged and canaliculate, puberulous in the grooves; terminal buds narrowly conic, acute, glabrous. Leaves occurring also on the second year's growth, 2-8 mm. apart; stipules narrowly deltoid, 1 mm. long; petioles 4-5 mm. long, one-thirteenth to one-sixth the length of the lamina, puberulous or glabrescent, deeply canaliculate above, rugose underneath, narrowly winged by the decurrent leaf-base; lamina thick-coriaceous, green, shiny above, dull and conspicuously punctate beneath, ovate, obovate or elliptic, 2.5-7 cm. long, 1.5-3 cm. wide, the margins slightly recurved, especially toward the base, crenate-serrate, the teeth 10-18 (usually 12-15) on each side, their tips brunnescens; midrib deeply canaliculate, shortly and sparsely puberulous above, elevated and glabrous beneath, the lateral nerves 5-7 pairs, obscure on both surfaces. Staminate inflorescences: 1-5-flowered cymose, solitary, axillary to the scales or lower leaves of the current year's growth or

fasciculate on the second year's growth; peduncles 3–5 mm. long, the pedicels 2 mm. long with 1 or 2 basal or submedian subulate prophylla, the uniflorous pedicels 3–6 mm. long, with 1 or 2 medial or supermedial prophylla; flowers 4-merous; calyx patelliform, 2–3 mm. across, glabrous, deeply 4-lobed, the lobes broadly deltoid, erose, eciliate; corolla rotate, ca. 7 mm. across, the petals obovate or orbicular, 2.5 mm. in diameter, one-fourth connate at the base; stamens two-thirds as long as the petals, the anthers oblong, 1.5 mm. long; rudimentary ovary narrowly conic, minute, the apex acute or shortly rostellate. Pistillate inflorescence: solitary, axillary, on current year's growth only; pedicels 12–15 mm. long, glabrous, gradually enlarged toward the distal half, with 2 subulate median prophylla; calyx 4–5 mm. in diameter, glabrous, 4-lobed, the lobes sub-orbicular; corolla rotate, 7 mm. across, ovate, 2.5 mm. long, one-fourth connate at the base; staminodes one-third as long as the petals, the sterile anthers sagittate; ovary ovoid, 2 mm. long, the stigma discoid, convex. Fruit globose or depressed-globose, black, 8 mm. long, 9 mm. in diameter, the persistent calyx explanate, 5 mm. in diameter, the stigma discoid-mammiform, the exocarp tunicate, the mesocarp very thin. Pyrenes 4, oval in outline, trigonous in cross section, back convex, rugose, striate, the striae slightly elevated, the sides smooth, 4–6 mm. long, 3–5 mm. wide, the endocarp sublignified or thick-coriaceous.

CHINA: Anhwei: Wang-shan, *R. C. Ching* 3025 (A, LU). Chekiang: Siachu, *R. C. Ching* 1747 (A, US), 1795 (A). Kiangsi: Lungnan, *S. K. Lau* 4711 (A). Fukien: Pu-cheng-kong, *R. C. Ching* 2504 (A, NY, US); Ku-liang, *H. H. Chung* 6786 (LU); Tangsiu-ging 6763 (A). Kwangtung: Wung-yuen, *S. K. Lau* 794 (A, NY); Sin-fung, *Y. W. Taam* 609 (A), 675 (A), 725 (A), 946 (A); Tseng-shing, *W. T. Tsang* 20195 (NY), 20411 (A, NY); Tsung-fa, *W. T. Tsang* 20601 (NY); Ta-pu, *W. T. Tsang* 21256 (A, NY), 21649 (A, NY). Hongkong: *Ford* (fruit, A, NY); *Ford* (pistillate flower, NY).

*Ilex viridis* Champ. ex Benth. was first described from specimens collected at Hongkong. It grows as a shrub up to 5 m. high. Its white flowers appear in May and its black fruits mature in October.

Loesener placed this species as a variety of *Ilex triflora* Blume. In superficial appearance the leaves and fruits of these two species are alike, but on close examination *Ilex viridis* can readily be distinguished from Blume's species by the inflorescences, fruit, and pyrenes. In *Ilex triflora* the staminate inflorescences are shortly pedunculate, the pistillate flowers are fasciculate, the fruits have small elevated stigmas, and the pyrenes are striate but esulcate. In *Ilex viridis* the staminate inflorescences have peduncles longer than the pedicels, the pistillate flowers are always solitary, the drupes have flat large stigmas, and the pyrenes are slightly rugose.

Professor E. S. Barghoorn of Harvard University has devised a method for microscopic study of the epidermis of both living and fossil plants as a means of identification. At his suggestion, I have examined both the lower and the upper epidermis of the punctate-leaved species of *Ilex*.



The lower epidermis of *Ilex viridis* with its numerous stomata arranged in groups is very different from that of *Ilex triflora* with a few diffused stomata.

30. *Ilex crenata* Thunb. Fl. Jap. 78. 1784; Willd. Sp. Pl. 1 (2): 710. 1797; Pers. Syst. Veg. 174. 1797, et Syn. Pl. 1: 151. 1805; Poir. in Lam. Encycl. Suppl. 3: 66. 1813; Roem. & Schult. Syst. 3: 491. 1818; DC. Prodr. 2: 16. 1825; Spreng. Syst. 1: 495. 1825; Dietr. Syn. Pl. 1: 556. 1839; Sieb. & Zucc. in Abh. Bay. Ak. Wiss. IV, 2: 147. 1845; Regel in Gartenflora 13: 39. 1864; Miq. in Ann. Mus. Bot. Lugd.-Bat. 3: 104 (Prol. Fl. Jap. 268). 1867; Franch. & Sav. Enum. Pl. Jap. 1: 76. 1873; Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29 (3): 21, 33. 1881; Tanaka & Ono, Useful Pl. Jap. 3: 2, fig. 668. 1889; Matsumura, Shokubutsu Mei-i 149. 1895; Ito & Matsum. in Jour. Sci. Col. Univ. Tokyo 12: 367. 1899; Nakagawa in Bot. Mag. (Tokyo) 13: 108. 1899; Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 199 (Monog. Aquif. 1: 199). 1901; Dallimore, Holly Yew Box 9, 120. 1908; Rehd. in Mitt. Deutsch. Dendr. Ges. 1908: 160. 1908, et in Bailey Stand. Cycl. Hort. 3: 1640. 1915; Chung in Mem. Sci. Soc. China 1: 140. 1924; Kia, Pl. Sin. Ill. 490, fig. 828. 1937; Chen, Ill. Man. Chin. Trees 657, fig. 548. 1937; Merr. & Chun in Sunyats. 5: 106. 1940; Makino, Ill. Fl. Nip. ed. 2, 369, fig. 1106. 1940; Rehd. Bibliog. Cult. Trees Shrubs 402. 1949.

*Ilex elliptica* Sieb. ex Miq. in Ann. Mus. Bot. Lugd.-Bat. 3: 104. 1867.

*Celastrus adenophylla* Miq. op. cit. 2: 85. 1865, 3: 104. 1867.

*Ilex crenata* Thunb. var. *typica* Loes. forma *genuina* Loes. op. cit. 201. 1901. *Syn. nov.*

*Ilex crenata* Thunb. var. *typica* Loes. forma *kusnetzoffii* Loes. op. cit. 202. 1901. *Syn. nov.*

A much-branched evergreen shrub up to 5 m. high with puberulous branchlets, small (usually less than 3 cm. long) coriaceous obtuse, rounded or acute, crenate-serrate leaves, 1-7-flowered cymose staminate inflorescences and solitary, (rarely in 3-flowered cymes) pistillate flowers.

Branchlets straight, cinereous, rarely castaneous or nigrescent, the side-shoots sometimes becoming thorn-like; third year's growth 3-4 mm. in diameter, plicate-rugose, minutely rimose, the lenticels sparse, oval or orbicular, the leaf-scars minute, crescent-shaped, elevated; second year's growth 2-3 mm. in diameter, puberulous; current year's growth 1-1.5 mm. in diameter, angular, cinereous or castaneous, densely pubescent, the terminal buds usually poorly developed, broadly conic, the scales loose, puberulous. Leaves occurring even on second year's growth, 3-10 mm. apart; stipules small, 1 mm. long, subulate, persistent; petioles short, 2-3 mm. long, one-eighth to one-sixth the length of the lamina, channeled above, keeled and transversely rugose beneath, pubescent or puberulous; lamina thickly coriaceous, olivaceous-brunneous, shiny and plicate-rugose above, opaque and punctate beneath, obovate, ovate or oblong-elliptic, 1-2.5 cm. (rarely up to 4 cm.) long, 0.5-1.5 (rarely up to 2) cm. wide; base obtuse,

acute or cuneate; apex rounded, obtuse, or subacute, mucronulate; margin crenate or serrate, the teeth 6–10 on each side; midribs plane or slightly impressed and puberulous above, prominent, elevated near the base beneath, the lateral nerves 2 or 3 pairs, obscure. Staminate inflorescences: cymose, 1–7-flowered, solitary and axillary to the scales or the lower leaves of the current year's growth or rarely pseudofasciculate on the second year's growth; peduncles 4–9 mm. long, the secondary axis when present 1 mm. long, the pedicels 2–3 mm. long with 1 or 2 sub-basal prophylla, the uniflorous pedicels 4–8 mm. long with 1 or 2 submedian prophylla; flowers 4-merous; calyx 2 mm. in diameter, glabrous, 4-lobed, the lobes broadly deltoid, erose; corolla 4 mm. across, the petals broadly elliptic, 2 mm. long, one-fifth connate at the base; stamens shorter than the petals, the anthers ellipsoid, 0.7 mm. long; rudimentary ovary conical, the apex slightly apiculate. Pistillate inflorescences: flowers solitary, or very rarely 2- or 3-flowered cymose, axillary, on the current year's growth only; pedicels 4–6 mm. long, club-shaped, ridged, with 1 or 2 submedian prophylla; flower 4-merous; calyx 3 mm. in diameter, the lobes rounded; corolla rotate, 6 mm. across, the petals ovate, 3 mm. long, one-third connate at the base; staminodes one-half the length of the petals, the sterile anthers sagittate; the ovary ovoid-conic, 2 mm. long, style sometimes evident, the stigma discoid, 4-lobed. Fruit black, globose, 6–8 mm. in diameter, the persistent calyx 3 mm. in diameter, explanate, the stigma minute, thickly discoid, 1 mm. in diameter, distinctly lobed. Pyrenes 4, oblong-elliptic in outline, 5 mm. long, 3–3.5 mm. wide on the back, smooth, striate, esulate, the striae slightly impressed, the endocarp coriaceous.

CHINA: Fukien: Yen-ping, *Dunn* 2468 (A).

JAPAN: Yezo: *S. Hori* in 1887 (A); *T. Tanaka* in 1929 (A). Hondo: *S. Arimoto* in 1903 (A); *R. K. Beattie & Y. Kurihara* 10438 (A); *Horomui* in 1885 (A); *J. G. Jack* in 1905 (A, G); *Maximowicz* in 1861 (G), in 1862 (G); *K. Miyabe* in 1891 (A); *Sargent*, Aug. 1892 (A), Oct. 1892 (A); *Siebold* (A); *Shiwaya* in 1885 (A); *K. Shiota* 68 (A); *K. Uno* 19111 (A); *Warburg* 8067 (A), 8071 (A); *E. H. Wilson* 7112 (A), 8195 (A); *Watanabe* in 1889 (G); *C. Wright* in 1853 (G). Shikoku: *E. H. Wilson* 7790 (A).

KOREA: *U. Faurie* (A); *E. H. Wilson* 9452 (A).

*Loesener* differentiated his two forms, *genuina* and *kusnetzoffii*, by the shape of their leaves, those of the former being obovate or ovate-elliptic, and of the latter ovate or ovate-elliptic. Among our numerous specimens I find many with both forms of leaves on the same branchlet. Thus there is no reason to separate them.

*Ilex crenata* Thunb. is a native of Japan, where it is widely distributed. Various cultivated forms occur there, whence they have been introduced into Europe and North America. The plant is hardy in the United States as far north as Boston. It is hoped that the following treatment will clarify the nomenclature of these cultivated forms, which has been badly confused.

## KEY TO THE VARIETIES AND FORMS

- A. Length of the leaves less than 3 times the width; the lamina ovate or obovate.
- B. Leaves on normal twigs ovate, obovate, oblong, elliptic, or even lanceolate, but not suborbicular and not crowded at the tips of the twigs.
- C. Leaves plane on both surfaces, the form and apices variable.
- D. Staminate cymes 1-5-flowered; the peduncles 2-5 mm. long; pedicels of the fruit 4-6 mm. long.
- E. Leaves over 15 mm. long, oblong-elliptic, the apex obtuse or subacute.....30a. f. *latifolia*.
- EE. Leaves less than 15 mm. long, ovate or oblong, the apex rounded.
- F. Margin of the leaves serrate, the teeth more than 6 on each side.....30b. f. *microphylla*.
- FF. Margin of the leaves subentire or with 2-6 teeth on each side; a greatly dwarfed shrub.....30c. f. *helleri*.
- DD. Staminate cymes 1-7-flowered; peduncles 10 mm. long; pedicels of the fruit 10 mm. long.....30d. f. *longipedunculata*.
- CC. Leaves convex, oblong, the apex rounded....30e. f. *convexa*.
- BB. Leaves crowded at the ends of the twigs, suborbicular.....30f. var. *mariesii*.
- AA. Length of the leaves 3-5 times the width, the lamina narrow-elliptic or lanceolate.
- B. Lamina entirely green.....30g. var. *longifolia*.
- BB. Lamina variegated.....30h. f. *luteo-variegata*.
- 30a. *Ilex crenata* Thunb. forma *latifolia* (Goldr.) Rehd. Bibliog. Cult. Trees Shrubs 402. 1949.
- Ilex fortunei* hort. ex Miq. in Ann. Mus. Bot. Lugd.-Bat. 3: 104 (Prol. Fl. Jap. 268). 1865, pro syn., non Lindl. 1857.
- Ilex elliptica* Siebold ex Miq. l.c., pro syn., non H.B.K., 1825.
- Ilex crenata latifolia* Goldr. in Garden 31: 129. 1887.
- Ilex crenata* var. *major* Nicholson in Kew Hand-list Trees Shrubs 1: 61. 1894, nom.; Dallimore, Holly Yew Box 121. 1908.
- Ilex crenata* var. *rotundifolia* Maxim. ex Matsumura, Shokubutsu Mei-i, 149. 1895, nom.; Murakoshi, Ic. Encycl. Bot. 5: 72, fig. 152. 1935, descr.
- A broad-leaved form with oblong or elliptic mature leaves 2-3 cm. long, 1-1.5 cm. wide, the margin serrate, the apex obtuse or subacute, the staminate cymes 1-3-flowered, the peduncles 3 mm. long, the pedicels 1-2 mm. long, in fruit 6 mm. long.
- JAPAN: Yezo: U. Faurie 6894 (A). Hondo: U. Faurie 6120 (A); C. S. Sargent in Sept. 1892 (A), in Oct. 1892 (A); S. Tashiro for E. H. Wilson in 1917 (A).
- This broad-leaved form is much cultivated in parts of Europe, Great Britain, and the United States.
- 30b. *Ilex crenata* Thunb. forma *microphylla* Rehd. in Mitt. Deutsch. Dendr. Ges. 1908: 160. 1908, et Bibliog. Cult. Trees Shrubs 402. 1949.

*Ilex crenata* var. *microphylla* Maxim. ex Matsumura, Shokubutsu Mei-i, 149. 1895, nom.; Rehd. in Bailey, Stand. Cycl. Hort. 3: 1640. 1915.

A dwarf shrub, the leaves oblong, ovate or obovate, the margin serrate with 6 or more teeth on each side, 9–17 mm. long, 5–6 mm. wide, the staminate cymes 1–5-flowered, subumbelliform, the peduncles 5 mm. long, the pedicels 1–3 mm. long, in fruit 5–6 mm. long.

JAPAN: J. G. Jack in 1905 (A); Kotobuki Idrikawa 104 (A); R. Oldham 140 (G, NY).

KOREA: U. Faurie 713 (A, B); T. Taquet 624 (A).

30c. *Ilex crenata* Thunb. forma *helleri* Rehd. in Jour. Arnold Arb. 20: 417. 1939.

*Ilex helleri* Verkade's Nurseries Cat. 1936: 13. 1936; Craig, Descr. Price-list, 1937: 31. 1937.

*Ilex crenata helleri* Fleming, Flem. Nurseries, 1937: 17. 1937, nom.; L. Chadwick in Am. Nurseryman 79(1): 21, fig. (cover). 1944; Rehd. Bibliog. Cult. Trees Shrubs 402. 1949.

A dwarf shrub of compact and crowded habit, the mature leaves elliptic, 8–11 mm. long, the margin crenate-serrulate with 2–4 teeth on each side.

CULTIVATED: United States: E. Morell in 1937 (A).

30d. *Ilex crenata* Thunb. forma *longipedunculata*, f. nov.

Frutex; foliis 2–3 cm. longis, 1–2 cm. latis, oblongis, obovato-ellipticis vel obovatis, apice rotundatis, obtusis vel subacutis; ♂ inflorescentiis cymosis, 1–7-floris, pedunculis 10 mm. longis, pedicellis 2–3 mm. longis; ♀ floribus solitariis, pedicellis 10–12 mm. longis.

A broad-leaved form with mature leaves 2–3 cm. long, 1–1.5 cm. wide, oblong, obovate-elliptic or obovate, the apex rounded, obtuse or subacute, the staminate cymes 1–7-flowered, the peduncles 10 mm. long, the secondary axis well developed, 1–2 mm. long, the pedicels 2–3 mm. long, in fruit 10–12 mm. long.

CHINA: Shantung: Tsingtao, First Park, C. Y. Chiao 2584 (TYPE, A; NY, UN, US, SS).

JAPAN: P. H. Dorsett & W. J. Morse in 1929 (A); J. G. Jack in 1905 (A); G. Masamune (NY); Rikuzen (G); Jugiyama Seiichi in 1931 (A); K. Sakurai in 1911 (A); C. Wright (G).

30e. *Ilex crenata* Thunb. forma *convexa* (Makino) Rehd. Bibliog. Cult. Trees Shrubs 402. 1949.

*Ilex crenata* var. *convexa* Makino in Jour. Jap. Bot. 5: 27. 1928; Terasaki Nipp. Shokubutsu Suppl. 2866. 1938; Makino, Ill. Fl. Nip. ed. 2, 369, fig. 1107. 1940.

*Ilex crenata* f. *bullata* Rehd. in Jour. Arnold Arb. 12: 73. 1931.

This convex-leaved shrub is cultivated in Japan (fide Makino) and in the United States. I have seen specimens collected in the Arnold Arboretum by Judd and Rehder.

30f. *Ilex crenata* var. *mariesii* Bean in Kew Hand-list Tree Shrubs ed. 2, 89. 1902, nom.; Dallimore, Holly Yew Box 122. 1908, descr.



*Ilex mariesii* Veitch ex Bean, Trees Shrubs Brit. Isl. **1**: 646. 1914, pro syn.  
*Ilex nummularia* Franch. & Sav. Enum. Pl. Jap. **2**: 311. 1878, non Reissek. 1861.

*Ilex crenata* var. *nummularia* (Franch. & Sav.) Yatabe in Bot. Mag. (Tokyo) **6**: 157. 1892; Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. **78**: 202 (Monog. Aquif. **1**: 202). 1901; Murakoshi, Ic. Encycl. Bot. ed. 3, **5**: 72, pl. 14, fig. 151. 1935; Makino, Ill. Fl. Nip. **369**, fig. 1107. 1940; Rehd. Bibliog. Cult. Trees Shrubs 402. 1949. *Syn. nov.*

A small shrub 1–2 m. high with leaves crowded at the ends of the twigs, the lamina ovate or suborbicular, 3–11 mm. long and wide, subentire or obscurely crenate, the teeth 1–3 on each side.

This form is cultivated in Japan and also at Kew (J. W. Bean!) and at the Arnold Arboretum (Rehder!). I accept the varietal name *mariesii* Bean (1902) as validated by Dallimore (1908) because Yatabe's varietal name *nummularia* was based on an invalid specific name.

30g. *Ilex crenata* Thunb. var. *longifolia* Goldr. in Garden **31**: 129. 1887.

*Ilex crenata* f. *longifolia* (Goldr.) Rehd. in Mitt. Deutsch. Dendr. Ges. **1908**: 161. 1908, et Bibliog. Cult. Trees Shrubs 402. 1949.

Mature leaves lanceolate or oblong-elliptic, 1–3 cm. long, 4–11 mm. wide, the normal length 4 or more times the width, the apex acute.

JAPAN: *E. H. Wilson* 6220 (A); Herb. Sci. College, Imp. Univ. Japan, in 1886 (A); *Sargent* in 1892 (A).

This variety is cultivated in Germany, Great Britain, and the United States.

30h. *Ilex crenata* Thunb. forma *luteo-variegata* (Regel) Rehd. in Mitt. Deutsch. Dendr. Ges. **1908**: 161. 1909.

*Ilex crenata* *luteo-variegata* Regel in Gartenfl. **13**: 39. 1864.

*Ilex crenata* var. *aureo-variegata* Goldr. in Garden **31**: 129. 1887.

*Ilex crenata* var. *variegata* Nichols. in Kew Hand-list Trees Shrubs **1**: 61. 1894, nom.; Rehd. in Mitt. Deutsch. Dendr. Ges. **1908**: 161. 1908; Bean, Trees Shrubs Brit. Isles **1**: 646. 1914; Dallimore, Holly Yew Box 122. 1908.

*Ilex fortunei* forma *aureo-variegata* hort. ex Schelle in Beissner & al., Handb. Laubh.-Ben. 291. 1903, nom.

A form distinguished chiefly by its yellow or golden variegated leaves. Cultivated at Kew. I have examined specimens collected by J. W. Bean and G. Nicholson.

31. *Ilex szechwanensis* Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. **78**: 347 (Monog. Aquif. **1**: 347). 1901, et in Sarg. Pl. Wils. **1**: 80. 1911; S. Y. Hu in Ic. Pl. Omei. **2**: pl. 169. 1946.

*Ilex szechwanensis* forma *calva* Loes. ex Diels in Bot. Jahrb. **29**: 436. 1900, nom. nud., et in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. **78**: 348 (Monog. Aquif. **1**: 348). 1901, descr. *Syn. nov.*

*Ilex szechwanensis* forma *puberula* Loes. l.c. *Syn. nov.*

*Ilex crenata* Thunb. var. *scoriarum* W. W. Sm. in Notes Bot. Gard. Edinb. **10**: 41. 1917; Anon. in op. cit. **17**: 278, 285, 305. 1930.

*Ilex triflora* Blume var. *viridis* sensu Comber in Notes Bot. Gard. Edinb. 18: 58. 1933, non Loes.

An evergreen shrub 1–3 m. high with puberulous subquadrangular branchlets, ovate-elliptic, ovate-oblong, or sublanceolate serrate, rarely crenate, punctate leaves, 1–7-flowered staminate cymes, peduncles of cymes longer than the pedicels, solitary pistillate flowers on current year's growth. 4–7-merous flowers, small elevated stigmas, and smooth striate esulcate pyrenes.

Branchlets olivaceous-brunneous, subquadrangular, third year's growth 3–4 mm. in diameter, the lenticels obscure or obsolete, the leaf-scars crescent-shaped, slightly elevated; second year's growth 2.5–3 mm. in diameter, subquadrangular in cross section, under a lens puberulous; current year's growth ridged and canaliculate, 1.5–2 mm. in diameter, minutely puberulous, especially the grooves; terminal buds usually well developed, conic, pubescent. Leaves occurring also on the second year's growth, 3–15 mm. apart; stipules scale-like, ovate-deltoid, acute, 1 mm. long, persistent; petioles 4–6 mm. long, one-tenth the length of the lamina, puberulous, shallowly grooved above, much or slightly winged by the decurrent leaf-base; lamina subcoriaceous or coriaceous, olivaceous, opaque or sometimes slightly shiny above, definitely opaque and punctate, sometimes puberulous especially along the midribs beneath, ovate-elliptic, ovate-oblong or rarely sublanceolate, 3.5–7 cm. long, 2–4 cm. wide, the base obtuse, rarely acute, the apex acuminate, the acumen deltoid, 3–5 mm. long; midrib plane or slightly impressed, puberulous above, elevated and glabrous or puberulous beneath, the lateral nerves 6 or 7 pairs, usually evident or sometimes obscure on both surfaces, the reticulation of the veinlets obscure. Staminate inflorescence: 1–7-flowered, cymose, solitary, axillary to the scales or basal leaves of the current year's growth, rarely fasciculate; peduncles 4–8 mm. long, the pedicels 2–3 mm. long, with 1 or 2 median or supermedian prophylla, the uniflorous pedicels 3–5 mm. long; flowers white, 4–7-merous; the calyx patelliform, glabrous or slightly puberulous, 2–2.5 mm. across, deeply 4–7-lobed, the lobes ovate-deltoid, 1 mm. long, erose or dentate, rarely ciliate; the corolla rotate, the petals 4 or 5-lobed, the lobes ovate, eciliate, one-fourth connate at the base; stamens shorter than the petals, anthers ovate-oblong; staminodes one-half the length of the petals, the sterile anthers sagittate; rudimentary ovary subglobose, the center shortly rostellate, inconspicuously lobed. Pistillate inflorescence: flowers solitary, axillary, on current year's growth only; pedicels 8–10 mm. long, with 2 supermedian prophylla; flowers 4-merous; calyx patelliform, 3 mm. across, shallowly 4-lobed, the lobes rounded, erose; corolla suberect, 4 mm. across, the petals ovate, 2.5 mm. long, one-sixth connate at the base; staminodes very minute, one-fifth the length of the petals, the sterile anthers sagittate; ovary subglobose-ovoid, 1.5 mm. in diameter, the style sometimes evident, the stigma thick-discoid, convex. Fruits globose or depressed-globose, 6 mm. long, 7–8 mm. in diameter, the persistent calyx explanate, 3.5–4 mm. in diameter, the stigma small, 1 mm. in diameter,

thickly discoid, distinctly 4-lobed, slightly elevated. Pyrenes 4, oval or suborbicular in outline, trigonous in cross section, 4.5–5 mm. long, 4 mm. wide, smooth, striate, the striae slightly impressed, the endocarp coriaceous.

CHINA: Kwangtung: Loh-chong, C. L. Tso 21157 (NY). Kwangsi: Tsu-yuen-hsien, T. S. Tsoong (Z. S. Chung) 83425 (A); Yao-shan, C. Wang 40222 (A). Hupei (Hupeh): A. Henry 5808 (ISOTYPES of *Ilex szechwanensis* var. *puberula*, A, US), 6912 (ISOTYPE, G); I-chang, E. H. Wilson 461 (A, US); Chien-shi, E. H. Wilson 1333 (NY); Chang-yang, E. H. Wilson 1333A (fragment, A); without precise locality, E. H. Wilson 1964 (A, NY, US). Hunan: Mo-fou-shan, Y. K. Hsiung 5900 (A). Kweichow: Fan-ching-shan, Steward, Chiao & Cheo 434 (A, NY), 634 (A, NY, US), 756 (A, NY, US); Kiang-kow, Y. Tsiang 7528 (NY), 7550 (A); Yin-kiang, Y. Tsiang 7845 (NY), 7974 (NY). Szechuan: Wu-shan, A. Henry 5716 (ISOTYPES, G, NY; fragment, A); Chung-king, S. Y. Hu 5001 (WU); Opien, T. S. Chao 595 (SS); C. Y. Yao 4438 (SS), 4576 (SS); Hung-ya, C. W. Yao 2266 (SS), 3900 (SS); Mt. Omei, C. Y. Chiao & C. S. Fan 807 (A); E. H. Wilson 4783 (A); Kwan-hsien, F. T. Wang 20770 (A). Sikang: Tienchuan, Y. S. Liu 1322 (A); Zayul, Kingdon Ward 10978 (B). Yunnan: Meng-tze, A. Henry 11012 (A, NY), 11303 (A); G. Forrest 7867 (ISOTYPE of *Ilex crenata* var. *scoriarum*, staminate flower, A), 8113 (ISOTYPE of *Ilex crenata* var. *scoriarum*, pistillate flower, A), 17642 (A), 17755 (A), 27391 (A), 27557 (A); Teng-yueh, J. F. Rock 7261 (A, US); Ping-pien-hsien, H. T. Tsai 60062 (A), 60276 (A), 61434 (A), 61660 (A).

*Ilex szechwanensis* was based on material collected on the Hupei-Szechuan border not very far from where the living *Metasequoia* has been recently discovered. There it grows as a shrub in thickets or on slopes, often near bamboo groves. Its white flowers appear in April and the fruit turns black in October. When Loesener described the species he cited no specimens. However, he enumerated three forms distinguished on the bases of the indumentum and leaf-form. I have before me isotypes of the first two forms, *calva* and *puberula*. With the numerous specimens from the same general area for comparison, I note such gradual variations in the density of the indumentum and in the leaf-form that I see no reason for maintaining Loesener's named forms. As to his forma *angulata*, I have seen no authentically named specimens, but I judge that it might prove to be merely a vigorous growth shoot.

The Yunnan and Kweichow specimens are much more pubescent than the other material; even the leaf-surfaces are puberulous. But the staminate inflorescences are cymose, and the peduncles are decidedly longer than the pedicels. These characters, plus the larger size of the leaves and the geographic factors involved, persuade me that it is better placed with *Ilex szechwanensis* than with *Ilex crenata* Thunb.

*Ilex szechwanensis* is intermediate between *Ilex crenata* Thunb. and *Ilex triflora* Blume. Like the former, it has staminate cymes with the peduncles longer than the pedicels and striate pyrenes with the striae slightly impressed. Like the latter, it has larger and thinner leaves. Its solitary fruits indicate kinship with *Ilex viridis* Champ. ex Benth., but the

latter has shiny leaves, impressed midribs, 4-merous flowers, plane and broad (2.5 mm.) stigmas and rugose pyrenes. Because of the widely separated geographic areas concerned, hybrid origin seems to be scarcely possible.

32. *Ilex triflora* Blume Bijdr. 1150. 1826; Dietr. Syn. Pl. 1: 555. 1839; Miq. Fl. Ind. Bot. 1 (2): 594. 1859; Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 344 (Monog. Aquif. 1: 344). 1901; Val. in Med. Dep. Landb. 18: 25 (Koord. & Val. Bijdr. Booms. Java 13). 1914; Goff in Lingnan Sci. Bull. 2: 64. 1930; Pitard in Lecomte, Fl. Gén. Indo-Chine 1: 852. 1912; Tardieu-Blot in Fl. Gén. Indo-Chine Suppl. 1: 719. 1948.

*Ilex horsfieldii* Miq. Fl. Ind. Bat. 1(2): 594. 1895; Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29(3): 21. 1881.

*Ilex triflora* Blume var. *horsfieldii* (Miq.) Loes. op. cit. 347. 1901; Valetton in Med. Dep. Landb. 18: 27 (Koord. & Val. Bijdr. Booms. Java 13). 1914; Koord. & Val. Atlas Baum. Java fig. 790, F-H. 1918. *Syn. nov.*

*Ilex triflora* Blume var. *javensis* Loes. l.c.; Valetton op. cit. 25. 1914; Koord. & Val. op. cit. fig. 790, A-E. 1918. *Syn. nov.*

*Ilex lobbiana* Rolfe in Jour. Linn. Soc. Bot. 21: 309. 1884.

*Ilex triflora* Blume var. *lobbiana* (Rolfe) Loes. op. cit. 346. 1901; Hand.-Mzt. Symb. Sin. 7: 658. 1933. *Syn. nov.*

*Ilex griffithii* Hook. f. Fl. Br. Ind. 1: 601. 1875.

*Ilex triflora* var. *kurziana* Loes. op. cit. 346. 1901. *Syn. nov.*

*Ilex theicarpa* Hand.-Maz. in Sinensia 3: 188. 1933. *Syn. nov.*

*Ilex fleuryana* Tardieu in Not. Syst. XII, 15: 119. 1945. *Syn. nov.*

An evergreen shrub or small tree with pubescent branchlets, oblong-elliptic or rarely ovate-elliptic or ovate minutely serrate leaves with punctate lower surfaces, fasciculate inflorescences, pubescent and ciliate calyx, globose or ellipsoid fruits and 4 smooth estriate, esulcate pyrenes.

Branchlets zigzag, ridged, subquadrangular in cross-section, rarely subterete; third year's growth 2 mm. in diameter, puberulous, plicate-rugose, the lenticels lacking, the leaf-scars subsemi-orbicular, slightly elevated; the second and current years' growth 1-1.5 mm. in diameter, ridged and canaliculate, pubescent; terminal buds poorly or not at all developed. Leaves even found on third year's growth, 2-12 mm. apart; stipules deltoid, acute, 1 mm. long, persistent; petioles 4 mm. long, about one-tenth the length of the lamina; lamina subcoriaceous, brunneous-olivaceous, opaque on both surfaces, puberulous or glabrescent at maturity, punctate beneath, elliptic, oblong or ovate-elliptic, rarely ovate or lanceolate, 3-9 cm. long, 1.5-4 (usually 2.5) cm. wide; base rounded or obtuse; apex acute or very shortly acuminate, the acumen 3-5 mm. long, very rarely obtuse; margin serrate, subundulate; midrib impressed and pubescent above, elevated and puberulent underneath, the lateral nerves 7-11 pairs obscure above, the reticulation of the veinlets obscure. Inflorescences fasciculate with abortive or rarely active terminal buds, axillary, distinctly pubescent all over; flowers 4-merous. Staminate inflorescences: individual branches of the fascicles 1-3-flowered, the peduncles of the 3-flowered cymes 2 mm. long,



the pedicels 2–3 mm. long, the prophylla 1 or 2, basal or submedian; the calyx patelliform, 3 mm. across, pubescent and sparsely ciliate; corolla rotate, 5 mm. across, the petals broadly ovate, one-fourth connate at the base; stamens slightly shorter than the petals, the anthers elliptic; rudimentary ovary pyramidal, the apex shortly rostellate, cleft. Pistillate inflorescences: individual branches of the fascicles uniflorous, the pedicels 6–14, rarely up to 18 mm. long with 2 median or submedian prophylla; calyx as in the staminate flowers; corolla suberect, the petals ovate; staminodes one-third the length of the petals, the sterile anthers cordiform; ovary ovoid, 1.5 mm. in diameter, the stigma thickly discoid, inconspicuously lobed. Fruit globose or ellipsoid, 7–8 mm. long, 7 mm. in diameter, the persistent calyx explanate, 4 mm. across, sparsely ciliate, the stigma discoid, 4-lobed. Pyrenes 4, oval-elliptic in outline, 6 mm. long, 4 mm. wide, smooth, striate, the striae slightly impressed, the endocarp coriaceous.

CHINA: Kiangsi: Hong-san, *J. L. Gressitt* 1545 (A); Yu-du-hsien, *H. H. Hu* 1177 (A); Kien-nan, *S. K. Lau* 3947 (A, US), 4474 (A, US). Kweichow: Cheng-feng, *Y. Tsiang* 4527 (NY); Tung-tze, *Y. Tsiang* 4997 (NY); Tuh-shan, *Y. Tsiang* 6645 (NY), 7031 (NY), 7073 (NY). Fukien: C. Fukien, *Dunn* (Herb. Hongk. no. 2467) (A); Hing-hwa, *H. H. Chung* 925 (A); Min-how-hsien, *H. H. Chung* 2190 (A); Ku-tien, *H. H. Chung* 4054 (A); Ku-liang, *H. H. Chung* 6444 (A, LU), 6786 (LU), 6878 (A); Ku-dien, *H. H. Chung* 7944 (A, LU); Hok-chiang, *Tang Singing* 15052 (LU), 15143 (LU), 15176 (LU). Kwangtung: Canton, *C. O. Levine* (CCC) 1477 (A, G); Lung-t'un Mt., *To, Tsang & Tsang* (CCC) 12315 (US); Wu-tung, *W. Y. Chun* 5772 (A); Pan-ling-tsze, *W. Y. Chun* 5909 (A, US); Nan-hao, *W. Y. Chun* 7752 (A); Wung-yuen, *S. K. Lau* 2145 (A), 2791 (A); Loh-fau Mt., *E. D. Merrill* 10930 (A); *Y. Tsiang* 1665 (A); Yao-shan, *S. S. Sun* 9968 (NY); Sin-fung, *Y. W. Taam* 213 (A), 336 (A), 705 (A), 853 (A); *W. T. Tsang* 900A (A); Ta-pu, *W. T. Tsang* 21022 (A, NY), 21187 (A, NY); Lung-men, *W. T. Tsang* 25318 (A), 25337 (A); Pok-lo, *T. M. Tsui* 80 (NY); Ying-tak, *T. M. Tsui* 407 (A, NY, US); Yang-shan, *T. M. Tsui* 780 (NY, US); Sun-wui, *Tso & Tsiang* 2043 (A, NY). Hongkong: *C. Ford* (US); *C. Wright* (US, G). Lantau Island: *W. T. Tsang* (Herb. Lingnan no. 16584) (A, LU, US). Hainan: Dung-ka, *N. K. Chun & C. L. Tso* 43846 (A, NY); Ling-shiu, *H. Fung* 20212 (NY, US); Po-ting, *F. C. How* 73163 (A); *S. K. Lam* 28047 (A); Yai-chow, *H. Y. Liang* 62081 (A), 62526 (A, NY). Kwangsi: *W. Po-seh, R. C. Ching* 7520 (ISOTYPE of *Ilex theicarpa*, NY; photo & fragment, A); Lu-chen, *R. C. Ching* 5793 (LU), 5899 (LU), 7058 (LU); Seh-feng-dar-shan, *R. C. Ching* 7805 (NY); S. Nan-ning, *R. C. Ching* 8210 (A, NY, US); Lin-yuin-hsien, *A. N. Steward & H. G. Cheo* 557 (A, NY); Shang-sze, *W. T. Tsang* 22071 (A), 22131 (A), 22377 (A); Wai-tsap, *W. T. Tsang* 22719 (A), 23235 (A), 24548 (NY); Hang-on-yuen, *T. S. Tsoong (Z. S. Chung)* 81732 (A); Yao-shan, *C. Wang* 39163 (A), 40592 (A). Yunnan: Sze-mao, *A. Henry* 12018 (A), 12018A (A, US), 12018B (A, US), 12018C (A, US), 12018D (A); without precise locality, *E. E. Maire* 3874 (photo and fragment, A); Shang-pa-hsien, *H. T. Tsai* 54396 (A); Ta-li, *C. W. Wang* 71723 (A); Fo-hai, *C. W. Wang* 73508 (A), 73521 (A), 73715 (A), 73844 (A), 75058 (A), 80178A (A).

INDO-CHINA: Tonkin: *Fleury* 32126 (TYPE of *Ilex fleuryana*, fragment, A); *A. Pételot* 5557 (A), 5756 (A), 5868 (A), 6278 (A); *W. T. Tsang* 27008 (A), 27069 (A), 27379 (A), 27488 (A), 29800 (A), 29043 (A), 29153 (A), 29329 (A), 30659 (A).

INDIA: Assam: *Jenkins* (ISOTYPE of *Ilex griffithii*, G); *Prain's Collector* 876 (A); Reporter Econ. Prod. Government India 11256 (A). East Bengal: *Griffith* 2001 (ISOTYPE of *Ilex griffithii*, A).

MALAY PENINSULA: *M. R. Henderson* 7349 (NY); *R. E. Holttum* (A); *Griffith* (ISOTYPE of *Ilex griffithii*, G).

SUMATRA: *Rahmat Si Bolla* 852 (A).

JAVA: *Blume* (A), *Blume* from Mt. Salak (A, probably a duplicate of the type); *H. O. Forbes* 1000A (A, G), 2901 (fragment, A, G); *Koorders* 9917 (fragment, A); *Zollinger* (A).

BORNEO: *H. Hallier* 2471 (fragment, A), 2483 (fragment, A); *Sarawak, Richards* 1963 (A).

The Lobb specimen at Kew labeled as from Luzon did not come from the Philippines. The Lobb specimens were mislabeled, duplicates of the same collection distributed as from Java, Borneo, the Malay Peninsula and Luzon. This specimen is the basis of *Ilex lobbiana* Rolfe, which, because of its supposed geographic occurrence, Loesener placed as a variety of the Javan *Ilex triflora* Blume. The specimen undoubtedly was from Java, though there is a bare possibility that it may have come from the Malay Peninsula or Borneo. See Merrill, E. D. Philipp. Jour. Sci. 10 (C): 190. 1915.

With all the specimens cited above, I cannot find any key character to separate the material collected from various geographic areas. I conclude, therefore, that *Ilex triflora* is a variable species. The species was first described from material collected in Java. The few Javan specimens available exhibit as great variation in indumentum, shape and size of the leaves, and length of the fruit pedicels as do the specimens from the several other geographic areas involved.

Loesener referred *Forbes* 1000A and 2901 from Java, as well as Horsfield's specimen, to *Ilex triflora* var. *horsfieldii*. I have compared the duplicates of these two numbers with authentic specimens of *Ilex triflora* and found no differences between them except that Forbes' specimens have longer pedicels (10–18 mm.) than those of Blume's which are in a flowering stage.

Loesener referred to *Ilex triflora* var. *lobbiana* not only the original Lobb material from "Luzon (?)" (which did not come from that island), but also a Griffith specimen from Malacca, a Teysmann specimen from Borneo and a Warburg specimen from Fuchow, China. I have seen duplicates of several of these. They are all similar to Blume's specimens in indumentum, color and texture of the leaves and fruits, and I see no reason for recognizing even a variety here, much less a species.

*Ilex griffithii* Hook. f. was based on a Jenkins specimen from Assam and Griffith specimens from Malacca and Assam. Griffith's Malaccan specimen is normal *Ilex triflora*. Jenkins' Assam specimen has rather large glabrescent oblong-elliptic leaves, more numerous lateral nerves, and

fasciculate inflorescences. It agrees with specimens cited from Yunnan and Indo-China.

When Handel-Mazzetti described *Ilex theicarpa* he overlooked the glands on the lower surfaces of the leaves. He says: "Proximae, quamvis

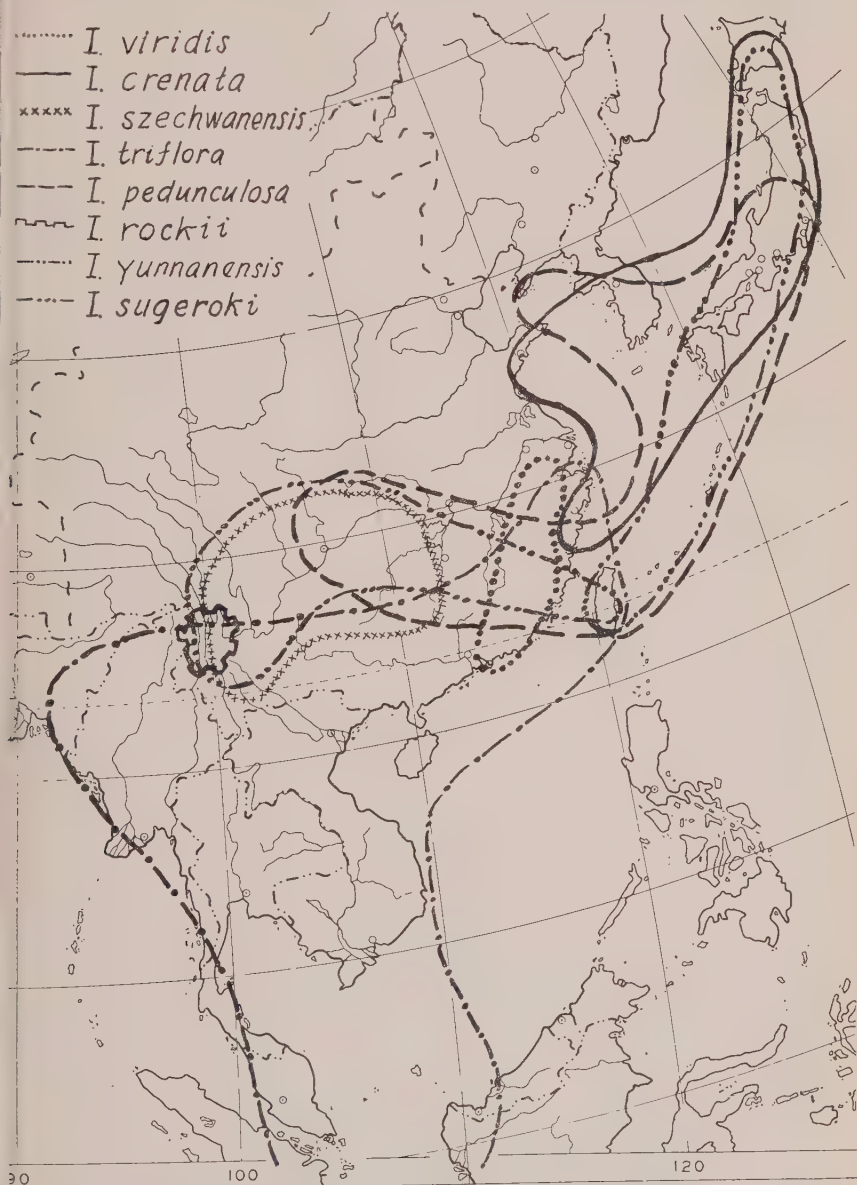


FIG. 7. Geographic distribution of the Chinese species of the section *Paltoria*.

folia epunctata, videntur *I. triflora* Bl. et *I. szechwanensis* Loes." Examination of an isotype shows that the leaves are distinctly glandular, but that the glands are obscured by the indumentum.

*Fleury 32126* (HOLOTYPE for *Ilex fleuryana* Tardieu) is a normal staminate branch of *Ilex triflora*. Its pyramidal rudimentary ovary is very characteristic of the species.

*Ilex triflora* is manifestly closely related to *Ilex crenata* Thunb., which differs in having smaller and fewer-nerved leaves, solitary fruits, and peduncles of the staminate cymes longer than the pedicels; yet Loesener placed the former species in [Sect.] *Aquifolium* and the latter in [Sect.] *Paltoria*.

In an attempt to find tangible differences I have studied intensively all of the specimens cited. I have made use of high magnification, and have examined the plants not once, but several times. I have tried to distinguish entities according to the density of the indumentum, the pattern of the inflorescences, the length of the pedicels, the form and size of the stigmas, the characters of the calyces, the form of the rudimentary ovaries, and the size and pattern of the pyrenes. In none of these could I find a constant character strong enough to warrant their separation. An attempt to distinguish them on the basis of their geographical location was no more successful. Specimens from widely separated areas, such as Hainan (*Lau 28047*), Kwangsi (*Ching 7879* and *8210*), Yunnan (*Henry 12018C* and *12018D* and *Wang 80178A*), and Indo-China (*Tsang 29800*) all impress me as being exactly like the Javan specimens. It is not logical to take certain plans and name them *Ilex triflora* Blume, and at the same time to put their next-door neighbors into another species, when morphologically there is no ground for doing so. My study led me to believe that what I had was a somewhat variable collective species whose center of origin was the region about the China-Indo-China border, where it flourishes, and that from there it had spread southward through the Malay Peninsula to Sumatra, Borneo, and Java, westward to Assam and Bengal, and northward and eastward into China.

In certain parts of China and in Taiwan forms which appear to be intermediate between *Ilex triflora* Blume and *Ilex crenata* Thunb. occur. These might be interpreted as weak species or as varieties of either of the two species. A good illustration of this is *Ilex crenata* Thunb. var. *scoriarum* W. W. Sm. Its staminate inflorescences are essentially those of *Ilex crenata*, and the leaves are those of *Ilex triflora* in form and size. Smith placed the variety under the former species, while Comber interpreted it as the latter. The form discussed immediately below falls in this same intermediate category.

32a. *Ilex triflora* Blume var. *kanehirai* (Yamamoto), comb. nov.

*Ilex crenata* Thunb. var. *kanehirai* Yamamoto, Suppl. Ic. Pl. Formos. 1: 31, fig. 11. 1925.

*Ilex kanehirai* (Yamamoto) Koidz. in Bot. Mag. (Tokyo) 43: 389. 1929; Kanehira, Formos. Trees 375. 1936.

*Ilex kanehirai* var. *glabra* Kanehira l.c. fig. 330. 1936.



An evergreen shrub with puberulous branchlets; leaves coriaceous or subcoriaceous, oblong, obovate or oblong-elliptic, the apex rounded, obtuse or rarely acute, never acuminate; inflorescences fasciculate, the staminate fascicles composed of 1-3-flowered cymes, the pedicels 2-4 mm. long, peduncles of 3-flowered cymes 1-2 mm. long, shorter than the pedicels; infructescences fasciculate, fruits globose, 5-6 mm. in diameter, the persistent calyx explanate, 3 mm. across, ciliate; stigma small, elevated, distinctly 4-lobed.

CHINA: Fukien: near the Chekiang border, *R. C. Ching* 2225 (B, LU, US). Kwangtung: Loh-fau-shan, *C. O. Levine* (CCC) 1597 (US); *F. P. Metcalf* 17507 (LU). Taiwan: *R. Kanehira* (photo of type of *Ilex crenata* var. *kanehirai*, TU); *E. H. Wilson* 10150 (A). Hainan: Five Finger Mt., *F. A. McClure* (CCC) 9394 (A).

*Ilex triflora* var. *kanehirai* is intermediate between *Ilex triflora* and *Ilex crenata* Thunb. It resembles the former in having fasciculate infructescences on the second year's growth and peduncles of the staminate cymes shorter than the pedicels. It resembles the latter only in its oblong-obovate leaves rounded or obtuse at the apex. Since *Ilex crenata* is characterized by solitary fruits found only on the current year's growth, it seems preferable to place this as a variety of *Ilex triflora*.

## SERIES 2. CASSINOIDES (LOES.), COMB. NOV.

*Ilex* subgen. *Euilex*, ser. A. *Lioprinus*, sect. 2. *Cassinoides* Loes. in Engler & Prantl, Nat. Pflanzenfam. Nachtr, 218. 1897, et in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 131 (Monog. Aquif. 1: 131). 1901.

Branchlets puberulous; leaves coriaceous or subcoriaceous, serrate or subentire, rarely entire; inflorescences solitary, axillary, on current year's growth only, staminate ones cymose, 3-9-flowered, pistillate ones usually uniflorous, rarely 3-flowered, the pedicels of the fruit 1-5.5 cm. long, rarely shorter; flowers 4-6-merous; calyx usually ciliate, the petals well united, the stamens shorter than the petals, the rudimentary ovary globose; fruit red, globose; pyrenes 4-6, smooth, neither striate nor sulcate, the endocarp thickly coriaceous or sublignescens.

## KEY TO THE SPECIES

- A. Leaves 5-8 cm. long, usually entire, sometimes serrate, the midribs plane or slightly impressed; leaf-apices acuminate; pedicels of the fruit 25-55 mm. long. (Central China and Japan).....33. *I. pedunculosa*.
- AA. Leaves less than 4 cm. long, serrate or rarely subentire, the midrib elevated and pubescent above; leaf-apices acute, obtuse or rounded; pedicels of the fruit 6-15 mm. long.
  - B. Leaves ovate-oblong, 15-30 mm. long, 12-18 mm. wide; petioles 8-9 mm. long, one-fourth to one-third the length of the lamina; flowers 4- or 5-merous. (Taiwan).....
  - .....33a. *I. pedunculosa* var. *taiwanensis*.

- BB. Leaves ovate, ovate-lanceolate or elliptic; petioles 2–5 mm. long, one-fourteenth to one-fifth the length of the lamina.
- C. Fruiting pedicels less than 4 mm. long; leaves obovate or oblong; the apex rounded. (Alpine Yunnan).....34. *I. rockii*.
- CC. Fruiting pedicels 10–15 mm. long (6 mm. long in a variety of *I. yunnanensis*); leaves ovate or ovate-elliptic, rarely lanceolate.
- D. Pyrenes 4; branchlets thickly ferruginous-pubescent; leaves aristate-serrate nearly to the base (except in one variety). (Western and Central China and Taiwan).....35. *I. yunnanensis*.
- DD. Pyrenes 4–6; branchlets puberulous; leaves serrate or crenate, the lower half entire. (Japan and Taiwan)....36. *I. sugeroki*.
33. *Ilex pedunculosa* Miq. in Versl. Med. Kon. Akad. Wet. II, 2: 83. 1868 [1866] (Repr. 19. 1866), et in Ann. Mus. Bot. Lugd.-Bat. 3: 106. 1867; Franch. & Sav. Enum. Pl. Jap. 1: 77. 1873; Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29 (3): 25, 37. 1881; Loes. ex Diels in Bot. Jahrb. 29: 435. 1900, et Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 108 (Monog. Aquif. 1: 108). 1901; Kia, Pl. Sin. III. 492, fig. 832. 1937; Makino, Ill. Fl. Nip. 367, fig. 1100. 1940.
- Ilex pedunculosa* f. *genuina* Loes. op. cit. 110; Chien in Contr. Biol. Sci. Soc. China 3: 58. 1927; Hand.-Mzt. Symb. Sin. 7: 655. 1933. *Syn. nov.*
- Ilex pedunculosa* f. *continentalis* Loes. ex Diels in Bot. Jahrb. 29: 435. 1900, nom. nud., et in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 110 (Monog. Aquif. 1: 110). 1901, descr., et in Sarg. Pl. Wils. 1: 76. 1913; Chien in Contr. Biol. Sci. Soc. China 3: 58. 1927; Rehd. in Jour. Arnold Arb. 7: 156. 1927, 14: 240. 1933; Masamune Fl. Kainant. [Hainan] 174. 1943. *Syn. nov.*
- Ilex purpurea* Hassk. var. *leveilleana* Loes. in Lévillé, Fl. Kouy-Tchéou 201. 1914.
- Ilex morii* Yamamoto, Suppl. Ic. Pl. Form. 1: 38, fig. 18. 1925.
- Ilex impressivena* Yamamoto, Suppl. Ic. Pl. Form. 1: 34, fig. 15. 1925; Kanehira, Form. Trees 373, fig. 329. 1936. *Syn. nov.*

An evergreen shrub up to 5 m. high with ovate subentire acuminate leaves, long slender fruit-stalks, and smooth esulcate and estriate pyrenes.

Branchlets straight, subterete; second year's growth 4–5 mm. thick, plicate-striate, the bark cinereous, the lenticels minute, circular, inconspicuous, the leaf-scars semi-orbicular; current year's growth 2–3 mm. in diameter, angular, brunneous-nigrescent, minutely puberulent especially below the nodes. Leaves occurring even on the third year's growth, 3–5 mm. apart; stipules deltoid, falcate-acute, 1 mm. long, persistent; petioles slender, 12–17 mm. long, one-fifth to one-third the length of the lamina, minutely puberulent, narrowly and deeply canaliculate above, plicate-rugose beneath; lamina thinly coriaceous, castaneous-nigrescent above, brunneous beneath, ovate to oblong-elliptic, 5–8 cm. long, 2–3 cm. wide; base rounded, rarely obtuse; apex acuminate, the acumen 5–10 mm. long;

margin entire, plane, slightly revolute near the base, often obscurely serrate near the apex; midrib slightly impressed above, puberulent or rarely glabrous, the lateral nerves very obscure on both surfaces. Inflorescences cymose, solitary, axillary, only on current year's growth, minutely puberulent; flowers 4- or 5-merous. Staminate inflorescences: cymes 3-9-flowered; peduncles 25 mm. long, the secondary axes sometimes 3 mm. long, the pedicels 2-4 mm. long, the bracteoles 1-1.5 mm. long, lanceolate, puberulent especially on the adaxial surfaces; calyx 1.5 mm. in diameter, patelliform, 4- or 5-lobed, the lobes deltoid, very acute, glabrous, sometimes sparsely ciliate; corolla rotate, 3 mm. across, the petals 1.8 mm. long, ovate, one-eighth connate at the base; stamens shorter than the petals, the anthers ovoid; rudimentary ovary subglobose, 0.5 mm. in diameter. Pistillate inflorescences: flowers solitary, very rarely 3-flowered cymose, the pedicels 4-4.5 cm. long, very slender, with 2 subulate supermedian prophylla 1 mm. long; calyx 3 mm. in diameter, 4- or 5-lobed, the lobes ciliate; corolla 5 mm. across, the petals 2 mm. long, ovate; staminodes shorter than the petals, the sterile anthers ovate; ovary broad-conic, 2 mm. in diameter, the stigma mammiform. Fruit globose, 7-8 mm. in diameter, red, when dry reddish brown, smooth, the stigma prominent, subpyramidal. Pyrenes 5 (4 ex Miquel, often 5 or 6 ex Loesener), elliptic in outline, trigonous in cross-section, 6 mm. long, 2.5 mm. wide, smooth, unistriate along the dorsal median line; the endocarp coriaceous.

CHINA: Launing: Dairen, Man-shu No-san Sho-kai Inc. (A); C. Wilford (G). Anhwei: S. Chen 2630 (A); Chien-shen-hsien, C. S. Fan & Y. Y. Li 187 (A); Wang-shan, W. C. Chong 4131 (US); R. C. Ching 3017 (A, LU), A. N. Steward 7158 (A, US); Chu-hwa-shan, R. C. Ching 2816 (A); S. C. Sun 1467. Chekiang: Tien-mo-shan, R. C. Ching 5189 (A). Kiangsi: Lu-shan, A. N. Steward 2643 (A); E. H. Wilson 1609 (A). Hupei (Hupeh): A. Henry 1702 (ISOTYPES of *Ilex pedunculosa* var. *continentalis*, A, NY), 4913 (NY), 5168 (G), 5910 (G), 6614 (ISOTYPE of var. *continentalis*, G, US); E. H. Wilson 477 (A, US), 1305 (A), 1325 (A, NY, US), 1976 (A), 1976A (NY), 2257 (A, K, NY, US), 2698 (A, K, NY, US), 3095 (A, US), 2699 (K, NY), 2700 (K, NY), 2700B (K). Hunan: Mo-fou-shan, Y. K. Hsiung 5898 (A). Szechuan: Kiang-yu-hsien, F. T. Wang 22271 (A). Kweichow: Pin-fa. J. Cavalerie 1066 (TYPE of *Ilex purpurea* var. *leveilleana*, fragment and photo, A); Yin-kiang, Y. Tsiang 7976 (NY). Kwangsi: San-chiang-hsien, Steward & Cheo 982 (A, NY). Taiwan: R. Kanehira 21177 (A); T. Suzuki 11728 (TU).

JAPAN: K. Beattie & Y. Kurihara 10149 (A); Buerger (ISOTYPE, G); Sci. Col. Imp. Univ. Jap. (A); U. Faurie 6895 (A); J. G. Jack in 1905 (A, G); H. Mayer in 1886 (A), Maximowicz in 1863 (G, NY); Siebold (A); K. Shiota (A); C. S. Sargent (A); K. Uno (A); E. H. Wilson 6024 (A), 6235 (A), 7479 (A), 7756 (A).

This species was first described on the basis of Japanese specimens, collected by Buerger, as a glabrous, entire-leaved, long-pedunculate and tetramerous species. A duplicate of the type collection is in the Gray Herbarium. The branchlets, petioles, and peduncles are shortly puberu-

lent. Additional material from Japan shows that even the calyx-lobes are sparsely ciliate (*Maximowicz*, in 1863). Similar specimens have been collected from many provinces in China.

This species occurs in cultivation in England and in the United States.

When Loesener differentiated two forms of *Ilex pedunculosa* he distinguished the continental from the Japanese form by the size of the leaves and the ciliate calyx. For f. *genuina* he says, "foliis tantum usque 9 cm. longis," and for f. *continentalis*, "foliis longioribus usque 12 cm. longis." With numerous Chinese specimens before me, including isotypes of f. *continentalis*, I find no leaves longer than 9 cm. The presence or absence of cilia and their density when present vary similarly in both Chinese and Japanese specimens. I see no reason for distinguishing two forms here.

33a. *Ilex pedunculosa* var. *taiwanensis*, var. nov.

Frutex; foliis subcoriaceis, integerrimis, suborbiculo-oblongis, 1.5–3 cm. longis, 1–1.6 cm. latis, basi rotundatis, apice acutis; costa supra plana et pubescente, nervis lateralibus utrinque 6 vel 7, subtus evidentibus; petiolis 7–9 mm. longis, quam laminis  $\frac{1}{4}$ – $\frac{1}{2}$  brevioribus; floribus femineis solitariis, axillaribus; pedicellis 11–14 mm. longis, floribus 4-meris vel raro calycibus 5-meris; corolla rotata, 6 mm. diametro; ovario ovoideo; stigmatе discoideo, stylo evidente.

CHINA: Taiwan: Tai-ho-ku-syû, *T. Suzuki* 18333 (TYPE, TU).

This variety is very closely related to *Ilex sugeroki* var. *brevipedunculata*, but the latter has plane pedicels 3–7 mm. long which are one-tenth to one-seventh the length of the lamina. Because of the proportionally long and canaliculate petioles, I think it is preferable to place this plant as a small-leaved variety of *Ilex pedunculosa*.

34. *Ilex rockii*, sp. nov.

*Ilex intricata* sensu Hand.-Mzt. Symb. Sin. 7: 658. 1933, pro parte; non Hook. f.

Frutex; ramulis pubescentibus; foliis obovato-oblongis, 1–2.5 cm. longis, 6–14 mm. latis, basi cuneatis, apice rotundatis obtusis vel raro subacutis, margine crenulato-serratis; costa supra elevata, pubescente, subtus obscura, glabra, nervis lateralibus utrinque 2–4, obscuris; inflorescentiis solitariis, raro subfasciculatis; pedicellis 2–4 mm. longis; floribus rubris, 5-meris, raro 4- vel 6-meris; calycibus patelliformibus, 3–4 mm. diametro, glabris, ciliatis; corolla rotata, 7 mm. diametro; petalis basi connatis, lobis 3 mm. longis; staminibus 5; staminodiis quam petalis brevioribus; ovario conico-ovoideo; stigmatе capitato; fructibus globosis, 5–7 mm. diametro; stylo evidente; pyrenis 5, 5 mm. longis, 3 mm. latis, laevibus, estriatis et esulcatis; endocarpio coriaceo.

A small shrub 1–2 m. high with distinctly pubescent branchlets, obovate-oblong serrate leaves, cuneate at the base, rounded, obtuse or rarely subacute at the apex, solitary pistillate flowers at the base of the current year's growth, and very short pedicels.

Branchlets stout, when dry castaneous or smoky; fourth year's growth



4 mm. in diameter, longitudinally rimulose, the lenticels lacking; third year's growth 2–3 mm. in diameter, smooth, densely puberulous; second year's growth tomentose, plicate-rugose, 1.5–2 mm. in diameter; current year's growth 1–1.5 mm. in diameter, castaneous, hirsute. Leaves occurring even on the fourth year's growth, 2–5 mm. apart; stipules minute, callose, deltoid, often persistent; petioles flattened, 2 mm. long, one-tenth to one-fifth the length of the lamina, plane above, pilose; lamina coriaceous, olivaceous-brunneous, shiny above, paler beneath, epunctate, obovate-oblong, 10–25 mm. long, 6–14 mm. wide; base cuneate; apex rounded, obtuse or rarely subacute; margins crenulate-serrate, the teeth prominent, 3–6 on each side, the lower half entire; midrib prominent, elevated, hirsute above, obscure and glabrous beneath, the lateral nerves 2–4 pairs, obscure above and beneath. Pistillate inflorescence: flowers solitary, axillary to scales at the base of the current year's growth; bracts coriaceous, caducous, ovate, 1–2.5 mm. long, ciliate; pedicels short and thick, 2–4 mm. long, glabrous or sparsely puberulous; prophylla none; flowers red (ex Rock), rather large for the genus, 7 mm. across, 5-merous or rarely 4- or 6-merous; calyx patelliform, 3–4 mm. in diameter, glabrous, rugose, the lobes normally 5, imbricate, deltoid, 1.5 mm. long and wide, rounded, obtuse or acute, erose and ciliate; corolla rotate, the petals ovate-oblong, 3 mm. long, 1.5 mm. wide, one-fifth connate at the base; staminodes one-half the length of the petals, the sterile anthers very minute, cordiform; ovary large, 2.5 mm. long and wide at the base, conic-ovoid, stigma capitate, distinctly 5-lobed. Staminate inflorescence: fasciculate, the stamens 5; only buds seen. Fruits globose, 5–7 mm. in diameter, the persistent stigma elevated, discoid, the style short, pedicels 2–4 mm. long. Pyrenes 5 (sometimes 3 or 4), 5 mm. long, 3 mm. wide, smooth, estriate, esulcate, the endocarp coriaceous.

CHINA: Yunnan: Mekong-Salwin Divide, *Handel-Mazzetti* 9617 (A); Kun-shan, Solola, *J. F. Rock* 22299 (TYPE, A; ISOTYPES NY, US), 22651 (A); *C. W. Wang* 66727 (A); Salwin-Kiukiang Divide, *T. T. Yu* 20228 (A), 20241 (A), 23150 (A).

The description of the fruit is drawn from *Yu* 20241.

*Ilex rockii* is a low alpine shrub occurring at altitudes of 4100–4330 m. in the high mountains of northwestern Yunnan. The red pistillate and pink staminate flowers appear in May and June, and its fruits turn red in September.

The plant is closely related to *Ilex crenata* Thunb., *Ilex luzonica* Rolfe, *Ilex yunnanensis* Franch., and *Ilex intricata* Hook. f. Superficially its leaves suggest those of *Ilex crenata*. That species, however, differs in having punctate lower leaf-surfaces, impressed midribs, 4-merous flowers, longer pedicels and striate pyrenes. *Ilex rockii* resembles *Ilex luzonica* in its 5-merous flowers, but differs in its lack of greatly elevated leaf-scars and punctate leaves with retuse tips. In the thick indumentum of the branchlets, elevated hairy midribs, flattened petioles, and smooth pyrenes, it resembles *Ilex yunnanensis*, which differs in having 4-merous flowers, ovate or ovate-elliptic leaves with slightly produced acute apices, longer pedicels,

and cymose staminate inflorescences. In its short pedicels and 5-merous flowers, it resembles *Ilex intricata*, which differs in its completely glabrous and peculiarly warty branchlets, impressed venation, and striate-sulcate pyrenes.

35. *Ilex yunnanensis* Franch. Pl. Delav. 2: 128. 1889; Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 131 (Monog. Aquif. 1: 131). 1901, et in Sarg. Pl. Wils. 1: 76. 1911; Rehd. & Wils. in Sarg. Pl. Wils. 3: 425. 1917; Rehd. in Jour. Arnold Arb. 7: 199. 1926; Anon. in Notes Bot. Gard. Edinb. 17: 29, 38, 48. 1929, 262, 381. 1930; Hand.-Mzt. Symb. Sin. 7: 655. 1933; Chen, Ill. Man. Chin. Trees 656. 1937; S. Y. Hu in Ic. Pl. Omei. 2: pl. 158. 1946.

*Ilex sugeroki* Maxim. forma *brevipedunculata* sensu Loes. l.c. 134. 1901; non (Maxim.) Hu.

A shrub or a small tree up to 12 m. high with ferrugineous-villose branchlets, small coriaceous ovate or ovate-lanceolate leaves, elevated and pubescent midribs, aristate-crenulate-serrate margins, cymose staminate inflorescences, solitary pistillate flowers on the current year's growth, 4-merous flowers, globose fruits, elevated discoid stigmas, and smooth coriaceous pyrenes.

Branchlets straight, fourth year's growth 3–4 mm. in diameter, cinereous, pubescent, smooth, minutely and longitudinally rimose, the lenticels lacking; second year's growth 1–2 mm. in diameter, ferrugineous-villose; current year's growth 1 mm. in diameter, densely villose, hairs golden, the terminal buds well developed, ovoid, acute, ferrugineous-villose. Leaves occurring even on the fourth year's growth, 3–10 mm. apart; stipules callose, buried in the indumentum, persistent; petioles 2–5 mm. long, one-fifteenth to one-seventh the length of the lamina, pubescent, slightly grooved above, flattened beneath; lamina coriaceous or thick-coriaceous, bruneous, usually shiny above, paler beneath, when young villose, especially near the base and along the margin, becoming glabrescent, ovate or ovate-lanceolate, rarely elliptic, 2–3.5 cm. long, 1–2 cm. wide; base rounded, obtuse or rarely narrowly subacute; apex acute, mucronate, sometimes ciliate; margin recurved, crenulate-serrate, teeth often aristate; midrib elevated and pubescent above, plane or slightly elevated, usually villose beneath, the lateral nerves obscure. Inflorescences cymose, solitary, axillary to leaves or scales of current year's growth, pubescent. Staminate inflorescences: cymes 1–3, usually 3-flowered, peduncles 8–14 mm. long, the pedicels 2–4 mm. long; flowers small, normally white, those from high altitudes pink or red, 4-merous; calyx subpatelliform, 2 mm. across, deeply 4-lobed, the lobes deltoid, acute or obtuse, ciliate; corolla rotate, the petals ovate, obtuse, 2 mm. long, 1.5 mm. wide, one-fourth connate at the base; stamens shorter than the petals, the anthers broadly ovoid; rudimentary ovary conic, the apex obtuse. Pistillate inflorescences: flowers solitary, very rarely 2- or 3-flowered cymose, the pedicels 8–14 mm. long with 1 or 2 supermedian prophylla; calyx as in the staminate flowers; corolla suberect, the petals 1.5 mm. long, one-third connate at the base;

staminodes one-half the length of the petals, the sterile anthers sagittate; ovary globose, 1 mm. in diameter, with 4 longitudinal grooves, style distinct, 0.5 mm. long, the stigma discoid, 4-lobed. Fruits red, globose, 5-6 mm. in diameter, the persistent calyx explanate, quadrangular in outline, ciliate, the stigma elevated, discoid. Pyrenes 4, oblong-oval in outline, subtriangular in cross-section, 5 mm. long, 3 mm. wide, estriate, esulcate, the endocarp smooth, thickly coriaceous.

CHINA: Szechuan: Mt. Omei, *H. C. Chow* 8361 (A), 12291 (A); *W. P. Fang* 11609 (Sz), 16912 (Sz), 23387 (A); *A. Henry* 7144 (NY); *S. C. Sun & K. Chang* 148 (A); O-pien, *C. L. Sun* 841 (Sz), 1133 (Sz); without precise locality, *C. W. Yao* 3774 (SS), 3872 (SS), 4284 (SS), 4328 (SS); Wen-chuan, *E. H. Wilson* 1024 (A, US), 3092 (US), 3094 (A, US); Kwan-hsien, *E. H. Wilson* 3093 (A, US). Sikang: Pao-shien (Mu-ping), *K. L. Chu* 3726 (SS), 3097 (SS); Lu-ting (Ta-chien-lu), *W. P. Fang* 3755 (A); *E. H. Wilson* 4135 (A); Tien-tsian, *Y. S. Liu* 1815 (A). Yund-shi Mountains (southeastern Tibet), *J. F. Rock* 23151 (A), 23654 (A, NY). Yunnan: Li-kiang, *R. C. Ching* 20637 (A); S. Chung-tien, *K. M. Feng* 3254 (A); western Yunnan, *G. Forrest* 4193 (K), 10247 (A), 13932 (US), 14174 (A), 19074 (A), 19459 (A, US); *Handel-Mazzetti* 8497 (A, US), 9141 (A, US); *J. F. Rock* 4196 (A, US), 8945 (A, NY, US), 9283 (A, US); Wei-si, *H. T. Tsai* 57995 (A), 59809 (A), 59911 (A), 63045 (A); *C. W. Wang* 63544 (A), 64002 (A), 64061 (A), 67868 (A); A-tun-tse, *T. T. Yu* 7864 (A); Ne-wah-lung, *T. T. Yu* 19230 (A); Tseh-chung, *T. T. Yu* 19018 (A).

UPPER BURMA: Nam Tamai Valley, *Kingdon Ward* 13296 (B).

*Ilex yunnanensis* is a large hardy shrub common in the high mountains of northern China. There it grows at altitudes from 1500 to 3100 m. The fragrant flowers appear in June. They are usually white, but on the snow range of northwestern Yunnan they are said to be pink or even red in color. Several varieties of the species have been proposed. These can be distinguished by the following key.

- A. Leaves ovate or oblong, the apex obtuse, the margin crenate; staminate flowers 4-6-merous. (Shensi, Hupei and N. E. Kweichow).....35a. var. *gentilis*.
- AA. Leaves ovate, oblong or lanceolate, the apex acute, the margin serrate, the teeth often aristate; flowers always 4-merous.
  - B. Fruiting pedicels less than 7 mm. long, the fruit nodding. (Border of Szechuan, Sikang and Yunnan)....35b. var. *brevipedunculata*.
  - BB. Fruiting pedicels 8-15 mm. long, the fruit erect.
    - C. Calyx ciliate.
      - D. Leaves entire or 1-3-toothed on each side (teeth spinose), thickly coriaceous, 2-3 cm. long, 1-1.5 cm. wide. (Yunnan).....35c. var. *paucidentata*.
      - DD. Leaves serrate, the teeth aristate; coriaceous, 1.2-2 cm. long, 0.5-0.7 cm. wide. (Taiwan).....35d. var. *parvifolia*.
    - CC. Calyx eciliate.....35e. var. *eciliata*.

- 35a. *Ilex yunnanensis* var. *gentilis* (Franch.) Loes. ex Diels in Bot. Jahrb. 29: 435. 1900, nom. nud. et in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 132 (Monog. Aquif. 1: 132). 1901, descr., et in Sarg. Pl. Wils. 3: 425. 1917; Chen, Ill. Man. Chin. Trees 656. 1937.

*Ilex gentilis* Franch. ex Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 133 (Monog. Aquif. 1: 133). 1901, in syn.

Leaves thin-coriaceous, ovate or oblong, the apex obtuse or rarely subacute, the base round, the margin crenate; staminate inflorescence cymose, the flowers 4-, rarely 5- or 6-merous.

CHINA: Shensi: Tai-pei-shan, *W. Purdon* 1114 (A). Hupei (Hupeh): *W. Y. Chun* 4214 (A); *A. Henry* 6901 (A, US); *E. H. Wilson* (Veitch Exp.) 2344 (A, NY, US), 4458 (A). Szechuan: Mt. Omei, *Y. S. Liu* 1195 (A); Wen-chuan, *E. H. Wilson* 4195 (A, US). Taiwan: Arisan, *E. H. Wilson* 9781 (A, US).

Several flowers (staminate) of *Wilson* 2344 are 5- or 6-merous. In this respect the plant more or less resembles *Ilex sugeroki* Maxim. var. *brevipedunculata* (Maxim.) S. Y. Hu. Because of the leaf-form and size, the indumentum and the geographic range, I think it is better to place it as a variety of *Ilex yunnanensis* rather than to transfer it to *Ilex sugeroki* Maxim. *Farges* 129, from Tschen-kéou-tin, Szechuan, is within the range of the distribution of this variety, and I suspect that it belongs here.

I have examined several specimens collected by Prof. A. Rehder in the Arnold Arboretum from plants grown from seeds obtained by Wilson in Hupei Province. The pubescence on the twigs of these cultivated forms is shorter and thinner than that found on the specimens of the wild *Ilex yunnanensis*. The venation of the leaves is more prominent than on the normal form. In appearance it looks more like *Ilex crenata* Thunb. than *Ilex yunnanensis*. Perhaps this is a demonstration of how environmental factors can affect the appearance and characters of the species.

- 35b. *Ilex yunnanensis* var. *brevipedunculata* S. Y. Hu in Ic. Pl. Omei. 2: pl. 158. 1946.

Leaves oval, ovate or elliptic, 2–3.5 cm. long, 1–2 cm. wide; fruiting pedicels 3–6, rarely up to 7 mm. long, the fruit nodding.

CHINA: Kweichow: Fan-chin-shan, *Steward, Chiao & Cheo* 842 (A, NY, US). Szechuan: Mt. Omei, *T. C. Lee* 6449 (Sz); O-pien, *C. W. Yao* 2834 (SS). Yunnan: Lap-ping, *H. T. Tsai* 54016 (A); Shang-pa, *H. T. Tsai* 54484 (A); Wei-si, *H. T. Tsai* 57918 (A), 59870 (A); *C. W. Wang* 63808 (A), 67842 (A), 68710 (A), 70457 (A); Ta-li, *C. W. Wang* 63344 (A), 63345 (A).

This variety occurs only at higher altitudes, 2600–3600 m. Its purplish red flowers appear in May and June. Its fruits are red by November.

- 35c. *Ilex yunnanensis* var. *pauidentata*, var. nov.

Arbor, 5 m. alta; foliis crasse coriaceis, ovato-lanceolatis, 2–3.5 cm. longis, 1–1.5 cm. latis, supra nitidis, basi rotundis vel obtusis, apice acutis



spinosisque, margine integris vel 1-3-denticulato-serrulatis; pedicellis 12 mm. longis; fructibus globosis, 4-5 mm. diametro, calycibus ciliatis, stylis perspicuis, stigmatibus discoideo, 4-lobato.

CHINA: Yunnan: Wei-si, *C. W. Wang* 67855 (TYPE, A).

The leaves of this variety are much thicker and more rigid than the typical *Ilex yunnanensis*. The leaf-tips terminate in a weak spine. More material may show it to be worthy of specific rank.

35d. *Ilex yunnanensis* var. *parvifolia* (Hayata), comb. nov.

*Ilex parvifolia* Hayata in Jour. Coll. Sci. Univ. Tokyo 30: 57. 1911, et Ic.

Pl. Form. 1: 134, fig. 19. 1911; Kanehira, Form. Trees 378, fig. 336. 1936. *Syn. nov.*

Leaves coriaceous, oblong-lanceolate, small, 11-20 mm. long, 6 mm. wide, serrate, teeth aristate.

CHINA: Taiwan: Arisan, *Faurie* 914 (A), 1377 (A); *E. H. Wilson* 9470 (A, US), 10917 (A, US); *Kamiyama* (TU).

In the nature and density of the indumentum, the texture and form of the leaves, the venation, the inflorescences, the fruits, and the pyrenes, the Taiwan and Yunnan specimens are alike. The only difference I have noted between them is that the Taiwan form has somewhat smaller leaves. I judge it to be worthy of varietal rank only.

35e. *Ilex yunnanensis* var. *eciliata*, var. nov.

Frutex, 1-3 m. altus; foliis tenuiter coriaceis, ellipticis, raro ovatis, 1-2.8 cm. longis, 4-12 mm. latis, basi acutis, raro obtusis, apice acutis vel obtusis; floribus 4-6-meris; calycibus patelliformibus, 2-3 mm. diametro, glabris, lobis 4-6, raro usque ad 9, deltoideis, acutis, eciliatis.

CHINA: Szechuan: Wen-chuan, *E. H. Wilson* 3092 (A); Hong-ya, Wa-wu-shan, *C. W. Yao* 2379 (SS), 2377 (SS), 3872 (SS); Mt. Omei, *S. N. Hsu* 16 (SS), *F. T. Wang* 23390 (A); O-pien, *C. W. Yao* 4328 (TYPE, SS). Sikang: Pao-shien (Mu-ping), *K. L. Chu* 2960 (SS), 2957 (SS); Tien-chuan, *C. L. Wu* 7225 (SS, UN), 12254 (SS, UN); *K. L. Chu* 2623 (SS).

The local name reported is "Shui-cha-tze," which means "water tea" or "the tea growing by the water." The leaves are collected by natives of the Sino-Tibetan Border and used as a substitute for tea. It is of interest to note that species of *Ilex* belonging to the same section have been used in a similar way by Indians of both North and South America.

*Ilex yunnanensis* is closely related to *Ilex sugeroki* Maxim. var. *brevipedunculata* (Maxim.) S. Y. Hu. The typical forms of the former have densely ferrugineous-villose branchlets, 4-merous flowers, 4 pyrenes, aristately crenulate-serrate leaves and acute apices. The variety of *Ilex sugeroki* has puberulous branchlets, 4-6-merous flowers, 5 or 6 pyrenes, and leaves coarsely serrate only on the distal half and obtuse at the apex. The former occurs in western China and the latter is found in Japan. In Taiwan the two elements meet. Sometimes it is difficult to decide to which species the Taiwan specimens belong.

36. *Ilex sugeroki* Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29 (3): 35, pl. 1, fig. 7 e. 1881; Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 133 (Monog. Aquif. 1: 133). 1901; Makino, Ill. Fl. Nip. 367, fig. 1101. 1940.

*Ilex sugeroki* forma *longipedunculata* Maxim. l.c. 36. 1881; Loes. l.c. 134. 1901. *Syn. nov.*

*Ilex sugeroki* subsp. *longipedunculata* (Maxim.) Makino in Bot. Mag. (Tokyo) 27: 78. 1913. *Syn. nov.*

An evergreen shrub up to 5 m. high with puberulous branchlets, coriaceous ovate or ovate-elliptic leaves with the margin serrate on the apical half, solitary axillary inflorescences, long-pedicellate (2–3.5 cm.) fruits, elevated discoid stigmas, and 4–6 smooth estriate esulcate pyrenes.

Branchlets puberulous, brunneous, older growth roughened by many elevated leaf-scars; third and second year's growth 2 mm. in diameter, the lenticels lacking; current year's growth 2 mm. in diameter, angular, pubescent, the terminal buds well developed, ovoid, 3 mm. long, 2 mm. wide, acute, with sparsely puberulous and ciliate scales. Leaves occurring even on the fourth year's growth, 5–10 mm. apart; stipules minute, callose, deltoid, persistent; petioles 4–7 mm. long, one-tenth to one-seventh the length of the lamina, pubescent, plane above; lamina thin-coriaceous, olivaceous, shiny above, opaque beneath, ovate or ovate-elliptic, 2–4 cm. long, 1–2.8 cm. wide; base rounded or obtuse; apex acute or shortly acuminate, the acumen 2–5 mm. long; margin serrate only on the distal half, midrib elevated and puberulous above, plane and glabrous beneath, the lateral nerves 6 or 7 pairs, obscure on both surfaces. Inflorescences solitary, axillary, on current year's growth only, puberulous; flowers 4-, 5-, or 6-merous. Staminate inflorescences: cymes 2–7-flowered, the peduncles 12–18 mm. long, the secondary axis 1–2 mm. long, the pedicels 2–5 mm. long, the bracteoles linear, 2 mm. long, puberulous; calyx patelliform, 2.5 mm. across, deeply 4–6-lobed, the lobes deltoid, densely long-ciliate; corolla white, rotate, 5–6 mm. across, the petals oblong, eciliate, one-sixth connate at the base; stamens shorter than the petals, the anthers oblong; rudimentary ovary ovoid, acute or shortly rostellate. Pistillate inflorescences: flowers solitary, the pedicels slender, erect, 3.5 cm. long, with 1 or 2 prophylla above the middle; calyx and corolla as in the staminate flowers; staminodes three-fourths the length of the petals, the sterile anthers oblong-sagittate, obtuse at the apex; ovary ovoid, 1.5 mm. long, glabrous, stigma elevated, discoid, plane and explanate. Fruits globose, 5–6 mm. in diameter, persistent calyx explanate, 3 mm. across, ciliate, stigma elevated, discoid. Pyrenes 4–6, oblong in outline, 3.5 mm. long, 2 mm. wide, neither striate nor sulcate, the ends obtuse, endocarp smooth, coriaceous.

JAPAN: Fujiyama region, *P. H. Dorsett & W. J. Morse* 384 (A). Hondo: Mino, *K. Shiota* 77 (A), 4363 (A), 6785 (A); *E. H. Wilson* (A).

*Ilex sugeroki* is endemic to the Fujiyama region of Japan. There it

grows as a shrub at altitudes of 1000–1500 m. Its white flowers appear in June. The fruit turns red in October and remains on the plants until the flowers appear the following June.

Maximowicz named two forms, distinguishing them by the length of the peduncles and the position of the fruits. He cited no specimens under these forms. Since the plant he illustrated as *Ilex sugeroki* is the large-leaved, long-pedicellate form, I am accepting it as typical of the species in the strict sense. According to this illustration, the leaves of the species are essentially ovate with a rounded base. However, most of our specimens have neither ovate leaves nor rounded leaf-bases. The fruiting pedicels of these latter are less than 2 cm. long. I interpret them as representing *Ilex sugeroki* Maxim. var. *brevipedunculata* (Maxim.) S. Y. Hu.

36a. *Ilex sugeroki* var. *brevipedunculata* (Maxim.), comb. nov.

*Ilex sugeroki* forma *brevipedunculata* Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29(3): 36, pl. 1, fig. d. 1881; Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 134 (Monog. Aquif. 1: 134). 1901. *Syn. nov.*

*Ilex sugeroki* subsp. *brevipedunculata* Makino in Bot. Mag. (Tokyo) 27: 78. 1913. *Syn. nov.*

*Ilex sugeroki* sensu Hara in Bot. Mag. (Tokyo) 50: 188. 1936, non Maxim.

*Ilex taisanensis* Hayata in Jour. Coll. Sci. Imp. Univ. Tokyo 30: 57. 1911, et Ic. Pl. Form. 1: 134. 1911; Kanehira, Form. Trees 382, fig. 339. 1936. *Syn. nov.*

A much-branched shrub up to 3 m. high with puberulous branchlets; leaves elliptic or ovate-elliptic, 2–3.5 cm. long, 1–1.5 cm. wide, cuneate or obtuse at the base, acute or obtuse at the apex, the margin serrate only in the apical half, the midrib elevated and puberulous above, plane or slightly elevated underneath, the petiole 3–8 mm. long, one-tenth to one-fourth the length of the lamina; inflorescences solitary, axillary, staminate 3-flowered, cymose, the peduncles 10 mm. long, the pedicels 1–5 mm. long, the prophyllum none or 1 near the calyx, puberulous; pistillate flowers solitary, pedicels 12–15 mm. long, prophylla 1 or 2, supermedian; calyx deeply 4–6-lobed, long-ciliate; fruit globose, 8 mm. in diameter, the stigma elevated, discoid.

CHINA: Taiwan: Bioritsu, T. Kawakami & U. Mori in 1908 (TYPE of *Ilex taisanensis*, photo and fragment, A; fragment, TU); Taihoku, S. Suzuki in Aug. 1928 (A, TU); Mt. Taiheizan, S. Suzuki in Aug. 1928 (TU).

JAPAN: Mt. Hakusan, (Herb. Sci. Coll. Imp. Univ. Jap.) (A); Shiribeshi, T. Ishikawa in 1893 (A); Oshima, K. Miyabe & Y. Fukubuchi in 1890 (A); Mt. Hakkoda, C. S. Sargent in 1892 (A); Mt. Nasu, K. Sakurai in 1909 (A); Echizen, K. Shiota 3453 (A); Mino, K. Shiota 5932 (A), 6393 (A); E. H. Wilson 7100 (A), 7183 (A), 7285 (A), 7632 (A), 7723 (A); Kitamifuji, Hokkaido, K. Uno 1581 (A), 1698 (A).

The color of the dry Taiwan specimen cited above is brunneous-nigrescent. This is probably due to the methods of preparation. At sight, specimens of this variety might easily be mistaken for *Ilex yun-*

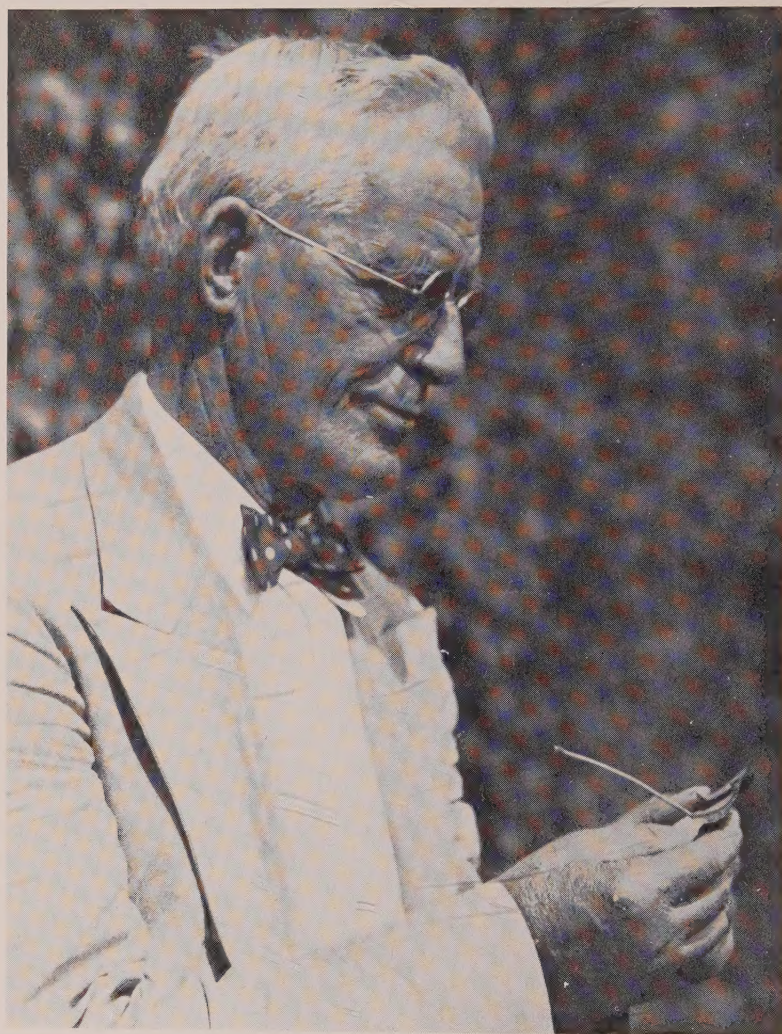


*nanensis* Franch., but the latter has densely ferrugineous-villose branchlets and its leaves are serrate or crenulate to near the rounded or obtuse base, while *Ilex sugeroki* var. *brevipedunculata* has puberulous branchlets and leaves which are serrate only on the upper half.

TO BE CONTINUED







JOHN GEORGE JACK